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UNITED STATES DEPARTMENT OF AGRICULTURE

² U.S. BUREAU OF PLANT INDUSTRY,
Division
OFFICE OF FOREST PATHOLOGY

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REPORT

ON THE
ERADICATION AND CONTROL
OF THE
WHITE PINE BLISTER RUST.



²
Calendar Year

⁵⁰
1917

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REPORT ON ERADICATION AND CONTROL OF THE WHITE PINE
BLISTER RUST, FOR THE CALENDAR YEAR 1917.

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The General Situation.

At the close of the season's work in 1916, the blister rust situation was as follows:

1. West of the Mississippi River the disease had been located at only two places, both in Minnesota, on nursery shipments. These shipments had been destroyed. No effective quarantine for this section existed at that time.

2. From the Mississippi River to the Hudson River. In this territory advance infections had been successfully stamped out in Ohio and Indiana. Serious local infections existed in Wisconsin and Minnesota, particularly in the territory within 40 miles of St. Paul. The disease was not known to be present in Michigan. It was known to exist scatteringly in western New York and Ontario, while the Niagara Peninsula in Ontario was seriously infected. Several infections, mostly in nurseries, had been found in Pennsylvania and New Jersey.

3. East of the Hudson River infection was general, particularly on Ribes, and there was no hope of completely eradicating the disease.

At the present time our territorial division of the problem

still holds good.. The states west of the Mississippi have been scouted, hundreds of potentially dangerous shipments of nursery stock of both 5-needle pines and Ribes have been found which will need to be watched for many years. So far, however, the disease has been found at only four points in the eastern part of this territory, namely, one nursery and one small planting in Minnesota, one small planting in northwestern Iowa, and one small planting in eastern South Dakota. None of these were located in such a way as to be dangerous.

Considerable attention has been attracted to the Cronartium on Ribes in Colorado which so strongly resembles Cronartium ribicola as to have been assigned that name. Its Peridermium stage has not been known hitherto, but during the past season was found on Pinus edulis and Pinus monophylla. Although this fungus has had opportunity to pass to planted Pinus strobus in Colorado and to native Pinus flexilis and Pinus aristata it has not done so, although the Cronartium itself is now definitely known to have been on Ribes in Colorado for at least 20 years. It is thus evident that whatever may be the final classification of this fungus with respect to name it does not need to be considered in relation to the 5-needle pines. It is probably a native fungus which is in no danger of becoming epidemic and which attacks only Pinus edulis and related species of nut pines.

On the whole, then, we may say that the situation west of the Mississippi is hopeful. The quarantine now established may be expected to prevent further shipment of 5-needle pines or Ribes into this territory and so the danger lies entirely in the possibility that the disease may have been introduced into this territory in the

past and is not yet found. As has been said repeatedly, if the blister rust should be introduced into this territory and should once become established under western forest conditions, its control even locally would be hopeless. Investigations have shown that there is a continuous distribution of susceptible species of Ribes connecting the ranges of the different species of 5-needle pines and providing natural means for the rapid spread of the disease throughout the West.

In the territory from the Mississippi River to the Hudson River the situation is on the whole hopeful. The disease has not been found in any state south of Ohio. In Minnesota and Wisconsin, the eradication areas which were cleaned up last year, have remained clean. However, extensive infections have been found outside of those areas in Minnesota and smaller infections in Wisconsin. There is still, however, good reason to suppose that the disease can be eradicated where found, the danger lying in unknown infections which may yet be discovered. Michigan has been thoroughly scouted and with the exception of one infected nursery has been found free from the disease. The infected lots of pine in this nursery have been destroyed. The disease has not yet been found in Illinois or Indiana and at but one place in Ohio, and that a nursery. All pine stock in this nursery has been destroyed. In western New York many infections occur on Ribes, some of which have been eradicated and some not. It is interesting to note that the Geneva area where the disease was first found 12 years ago is now apparently, after years of effort, free from the disease, at least on Ribes. If the disease does not recur, this place will serve to demonstrate that

Policy and General Plan of Blister Rust Work in 1917.

The policy of this office has been to conduct necessary scientific investigations in problems relating to the life history, eradication and control of the fungus; and to cooperate to the fullest possible extent with all of the states in which white pine is an important tree, to discover the disease and assist in its control or eradication, when found. The development and direction of co-operative work this year was left in the hands of the state officials, the Federal Department acting in an advisory capacity. However, the expenditure of Government funds was checked up through a force of inspectors and special assistants who were paid from Government funds. In New England, because of the general blister rust infection found in 1916, special effort has been made to carry out the policy recommended in the following resolution of the Committee on the Suppression of Pine Blister Rust in North America, adopted at the conference at Albany, New York, on November 20 and 21, 1916:

"Resolved that federal and state co-operative experiments be carried on to determine the best methods, costs and results of eradicating currants and gooseberries and pines on a large as well as on a small scale and under varied conditions."

Outside of the region of general infection, namely, Pennsylvania and the southern Appalachian region, the Lake states, the Middle West, the Rocky Mountains and the Pacific Coast, the work this year has been limited to vigorous scouting for the blister rust in cooperation with the various states, for the purpose of eradicating spot infections. Thorough scouting and experimental control were conducted in New York, because this state is located partly within and

partly outside of the area of general infection.

In explanation of the special emphasis laid upon experimental control in the New England States and New York, it was made clear at the Albany conference that the problem presented by the general outbreak of blister rust in the East could not be solved before necessary data on costs, methods and possibilities of eradicating currants and gooseberries were obtained. At the same time it was desired to secure results that would be of permanent value. It appeared that this would be best accomplished by concentrating the work on definite areas which would serve as experimental areas for future study, as a demonstration of preventive measures, and as a trial of the methods and costs. The selection of experimental areas and the methods followed was left largely to the judgment of the state officials in charge, because it was the purpose to compare methods and results, and select that which proved best for future work. The one feature of cooperative control work insisted upon by the Federal Government was that all currants and gooseberries (wild and cultivated, diseased and non-diseased) should be eradicated, so far as humanly possible, from the demonstration control areas. This insistence was based upon the known habits of the fungus, which make it clear that in a region of general infection, any currant or gooseberry bush in the vicinity of five leaved pines is a menace to the trees.

Scouting and Control in the Eastern States.

The blister rust work in the East has been confined principally to the development of demonstration control areas in the New Eng-

land states and New York. Because of the very general distribution of the blister rust on Ribes last year in New England, organized scouting was conducted on a very limited scale in these states, but in New York, New Jersey, Pennsylvania, Maryland, West Virginia, Virginia, North Carolina, South Carolina and Georgia more extensive scouting was done than in 1916.

The outbreak of war delayed state appropriations to such an extent that field work in most states did not begin until some time in May. Throughout the season the war has had the effect of causing numerous delays and inconveniences, partly due to men resigning to enlist, or because they were drafted, and partly because of the unusual demand for labor and the generally high rate of wages.

The distribution of Ribes infection in New England was apparently about the same as last year but a number of previously unknown pine infection centers of considerable extent and age were found. The most important new development in the East is in New York State, where the area of general infection has been extended to include all of the best native white pine growth, and isolated infections found widely scattered from Long Island to the shores of Lake Ontario and Lake Erie. Only four infections in planted pines were found in Pennsylvania, and no Ribes infection, but heavily infected Ribes were found south of Ithaca, New York, twenty miles north of the Pennsylvania line. In New Jersey pine infection was found at only two of the seven places where it was discovered in 1916, and no new infection points

were found. No disease has been found south of Pennsylvania.
Digest of State Reports, 1917.

Maine: Ribes infection is general as far north as a line from Rangeley through Greenville, Millinocket to Houlton. Most of the valuable pine growth extends from the 45th parallel south to the coast. In addition there are several thousand acres of planted pine.

The Kittery Point control area covers approximately three square miles and includes one of the worst known pine infections in the east. From this area 13,236 Ribes (mainly gooseberries - 96%) were removed, 57% of which were diseased. Part of the area was scouted twice and it is estimated that 90% of the Ribes have been found and destroyed. Owners of cultivated Ribes within the eradication area cooperated more or less willingly by allowing their bushes to be destroyed and no compensation was given. No diseased pines were removed. The cost of eradication was \$1.50 per acre and is considered excessive because of the following factors:- High cost of maintenance on this area, inexperience of crew, and expense of going over some of the area twice. The best working unit was found to consist of a crew of four or five men and foreman, working in a line six to fifteen feet apart depending on topography and ground cover.

Another control area located at Alfred was selected because of the value of the pine, slight amount of disease, cooperation of land owners and desirability of having this type of growth for a demonstration control area. This area comprises

approximately five square miles and yielded 36,370 Ribes as follows:

18,900 skunk currant - 52%

16,071 wild gooseberry 44%

1,399 cultivated Ribes 4%

36,370 100%

This averages about 11 plants to the acre as compared with seven plants per acre for Kittery Point area. Several diseased Ribes were found on ^{the} Alfred area, but no infected pine. The cost of eradication was about \$250 per square mile or approximately 39¢ per acre.

Limited scouting was conducted to find ^{the} northern limits of spread of the rust on Ribes. No new centers of pine infection were found although some unknown diseased pine were discovered near the old infection centers.

The state expended \$2,700.65 to November 1, 1917, and a few bills are still outstanding, so that the total expenditure will probably be about \$3,000.00. Professor John M. Briscoe, Orono, Maine, was in charge, under the direction of the Forest Commissioner.

County Agents are actively aiding in spreading information relative to the blister rust among the people. Literature, posters and colored post cards illustrating and describing the disease have been widely circulated.

The following recommendations are made by Professor Briscoe for work in Maine in 1918:-

1. The work should begin as early in the season as the leaves are out, not later than May first in this state.

2. Expenditures should be chiefly concentrated in the employment of men for eradication work, at from \$50 to \$60 per month each. Men who are not worth the price should be promptly eliminated. Cheap labor in this work is the most expensive and the least efficient.

3. It will probably be easier to select a good crew next year because more time can be given to the choice of applicants. It is likely that student labor will have to be used very largely on account of the scarcity of local labor, particularly in the summer season here.

4. The two areas already worked on should first be gone over again very thoroughly, to see the exact result of this year's work and to make sure of a complete eradication of ribes.

5. The area at Bath should also have attention, and a control area of not less than five square miles should be established there between Bath and Brunswick. This will require the employment of about twenty men in all, six men in each crew including the foreman, and a supervisor and his assistant to take entire charge of the three crews. In this way a much larger area could be gone over than with the single eradication crew used the past season. An automobile should be provided for this work so as to enable supervision of the three crews.

6. Very little time need be given to scouting. The main stress should be put on experimental control areas, and in educational and publicity measures. It would seem that by such measures alone can any permanent good results be accomplished.

New Hampshire: Scouting began May 10 and ended July 14.

Twenty-one towns were covered and the following new outbreaks on native pine were found:

Stratham - 5	North Conway - 11
Bartlett - 1	Littleton - 2
Bethlehem - 1	Lisbon - 2
Bath - 3	Landoff - 3
Lyman - 3	Orford - 1
Dover - 1	Warren - 2

Planted pines were found diseased in Milford and Conway.

The largest native pine infection in the State was found at Stratham where on twenty-five acres, practically every tree had one or more infections and on one tree more than 600 diseased twigs and branches were removed. At Intervale, New Hampshire, pine infection was discovered in the Cathedral Pines, and in a pine hedge, nearby, 1,060 diseased branches were removed, 698 of which were producing aecia.

Wild Ribes are prevalent throughout the State, the wild gooseberry (*R. cynosbati*) being most common while the skunk currant is very abundant in certain sections; of those found at North Conway over 90% were badly diseased. The best pine growth occurs in Central and Southern New Hampshire.

The aecial stage was found May 10; the uredo June 6, and the telial July 10; the latter appearing on skunk currants. Also the aecial stage on pine was found in the town of Lyman as late as July 23rd.

Demonstration control areas were located in the towns of Bath, Conway, Stratham and Keene. These areas were selected because of the amount of infection, the abundance of pine, and for the educational value of the localities. General currant infection exists on all the selected control areas. There is also some pine infection, the worst of which was at Stratham where it is beginning to cause very considerable damage to the pine.

About 30 men were employed on the eradication work in New Hampshire. One crew was maintained in camp and this was

found to be the most economical method of keeping the men and has many other advantages such as solving the transportation question, hours of work, etc. The best size for crew was found to be six men and a foreman, although smaller units were found to be better in North Conway. The size of the crew is governed by local conditions and personnel.

Name	: Area : Acres	:No. of :wild :Ribes :Destroyed	:Average :percent- :age of :Ribes dis- :eased	:Total :No. of :cultivat- :ed Ribes :removed	:No.of: :dis- :eased: :Cult.	:Average :Cost of :Eradica- :tion per :acre
North Conway	: 1,028	: 27,825	: 90%	: 1406	: 311	: .898
Stratham	: 11,520	: 104,000	: 40%	:	:	: .38
Bath	: 75 mi. : of high- : way	: 15,000	: 80%	:	:	: .?
Keene	: 2,560	: 300,550	: 35%	: 1250	: 789	: .327

On the North Conway area, out of a total of 27,825 wild Ribes, 27,684 were skunk currant, 129 red currant, and 12 wild gooseberries. Of the 1,406 cultivated Ribes removed, 1,095 were undiseased and of the latter 429 were destroyed and no compensation was asked by the owners. The compensation for the 666 undiseased bushes paid for amounted to \$306.70 or an average cost of .462¢ per bush. Patience, care and diplomacy is necessary in arranging for the removal of all cultivated Ribes bushes. Such work cannot be delegated to any of the crew, not even the foreman, but should be handled by an older man and he should be equipped with a fixed schedule of prices from which there is no appeal. No cultivated bushes were removed in the Stratham area in 1917, but this work will be taken up in 1918.

In the Stratham area wild gooseberry was the principal wild Ribes found; next in abundance was red currant; skunk currant was found only in one small area. Practically all the wild Ribes found in the Keene area were skunk currants. Of the 1,250 cultivated Ribes, 461 were not diseased and were paid for. The total compensation for these bushes was \$81.35, averaging 17.6¢ per bush.

On the Bath area, the work consisted of eradication of wild Ribes along 75 miles of highway,, taking the areas lying between the road and fence or stone-wall.^{This} was the first method tried out. On the completion of the roads it was planned to then take up the eradication on wild lands.

It is now believed that such a scheme is a poor one and that the better and more efficient way is to divide the total area into plots, using the natural boundaries such as streams, stone-walls, roads, etc., and through these tracts eradicate by the strip method, the width of the strips being determined by the nature of the existing growth. Where cost on different types is desired, these areas can be sub-divided according to the forest types which they contain.

A brief trial of outlining the work to the crew foremen and then leaving them to carry on the work alone in the absence of the field agent, demonstrated clearly that it is advisable to secure a town superintendent who can properly manage the crews and map the control area.

In several cases, private owners of pine timber furnished the labor and the State paid only a trained man to supervise

eradication work. In Dover and Rollinsford, 2 adjoining estates totalling 900 acres were eradicated and 5000 wild Ribes removed. At Durham, Mr. Rollins had the wild Ribes on his estate removed and 1500 bushes were found. Also Messrs. Jones & Plummer, of Milton, eradicated the Ribes on their farms. As a result of an educational and publicity campaign in Stratham County, 40 people were pledged to eradicate Ribes on their properties and 26 of them promised to commence work in the spring, the work to be supervised by a trained man employed by the State.

There are no commercial Ribes growing areas in the State, and no blister rust was found in nurseries this year. Education of the public in blister rust was accomplished through illustrated lectures, personal inspections, correspondence, distribution of U. S. D. A. Farmers' Bulletin 742, and State circulars and posters.

The work was under the supervision of L. E. Newman, directed by the State Forester. A total of about 45 men were employed, the regular working force being over 30 men. Two men resigned to enlist and two were drafted. The average salary for the men employed in the state was \$44.26 per month, and the average cost of subsistence, including transportation was approximately \$1.80 per man per day. There was no special difficulty in securing laborers in New Hampshire in 1917, but it will probably be more difficult to secure good men next year. In 1917, the state expended a total of \$10,390.18 to November 1.

The following recommendations are made in the New Hampshire report:

1. A chief and Assistant in each control area, (the latter if necessary).
2. A type-map of eradication area, prepared before the work begins and the chief of the area to finish mapping the town.
3. Squad leaders to turn in detailed data of daily work.
4. Bi-weekly crew meetings held by Chief of each area to discuss work.
5. Cooperative private eradication promoted by a special agent to work in cooperation with each County Agricultural Agent.
6. Educational and publicity work through monthly follow-up system of posters, cards, etc.

Vermont: Scouting this year was limited to ^{the} examination of (planted) Ribes between the two oldest and largest/pine infection centers in the state - Woodstock and Lyndonville, (July 1st to July 14th). This scouting proved that infection was present throughout the area and could not be definitely traced to any single pine infection center. From Woodstock to Norwich 1.8 per cent of the bushes were infected, whereas from Norwich to Lyndonville, 9.3 per cent of the bushes were diseased. Of the total number of bushes infected, 42.8 per cent of the blacks were diseased, 35 per cent of the wild gooseberries, .8 per cent of the domestic gooseberries, 7.7 per cent of the cultivated red currants .0 per cent of the cultivated white currants and 11.0 percent of the flowering currant.

The worst native pine infection in the state was found at South Royalton on the Eaton estate where 20 to 25 pines were found infected. The different stages of the rust in Vermont were first found this year as follows:

Aecial	-	Lyndon	-	May 29th
Uredo	-	Sharon	-	June 22nd
Telial	-	Royalston-		July 10th

High school boys were employed part of the time and gave fairly satisfactory service. A total of 44 men were employed, several of them for short periods only. No men were lost by the draft although good labor is scarce.

Ribes eradication was carried on from June 25th to October 13th, as follows:

Woodstock	-	3 sq. miles
Royalston	-	about 1 sq. mile
Lyndon	-	small section of town
Sharon	-	State farm (about 1 square mile)
Thetford	-	7 sq. miles

The most abundant Ribes found were wild gooseberries. Skunk currants are plentiful in some sections of the state, but only ^{were} a few/encountered in this year's work.

Ribes were eradicated for 1/4 mile in the vicinity of all known infected pine areas, but only one real demonstration area was established and this is located at Thetford. This area was selected because it contains excellent stands of pine; is typical of Vermont pine area; is easily accessible, and has very few cultivated Ribes.

The topography is very rugged and Ribes infection was found to be general. No cases of pine infection were discovered. Four crews worked on the area (one only a short time) and their size varied from 2 to 7 men and foreman. The best size crew is 5 to 7 men and foreman depending on whether ^{the} region is rough or level. Approximately 900 days' work was done on this area (by one man) at a cost of about \$400.00 per sq. mile. If 68 men were employed

and 28 sq. miles covered in a season, it would take over 21 years to cover the 600 sq. miles of pine in the State at a cost of about \$240,000 (one eradication). The cost of blister rust work in Vermont to November 1, 1917 (state funds) was \$3175.16, of which \$77.05 was spent in compensation for cultivated Ribes destroyed in eradication. Harold L. Bailey was in charge of the work, under the direction of the Agricultural Commissioner.

No disease was found in nurseries and it is believed that no nursery is handling white pine. There are no commercial Ribes growing areas in the state. The white pine stock in the state nurseries was exposed to infected Ribes in 1916, so the stock was destroyed this year.

No cooperative eradication was attempted as education of the public is necessary first. A lantern has been purchased and illustrated lectures are being arranged for this winter. Printed matter is being distributed and 5000 posters have been purchased which will be put up in public places for the enlightenment of the people.. The attitude of the latter is more or less one of indifference, because they do not understand the seriousness of the disease and only a comparatively few are interested in white pine. It is hoped to counteract this by educational methods and by appealing to their public spirit for the welfare of the state.

The following recommendations are made in the state report:

1. Work of mapping and plotting new eradication areas should be done during the winter, before work begins, and type areas should be carefully bounded and their dimensions definitely known.

2. One man should keep uniform records for all crews and the time of laborers.

3. Re-eradication in 1918 is suggested for the areas at Thetford, Sharon, So. Royalston and Brookfield, early in the spring. Similar work at Woodstock and Lyndon¹s of doubtful value. Establishment of new control areas next year is not favored.

Massachusetts: The work in Massachusetts was directed by a committee, informally organized, consisting of the State Forester, the Secretary of the Board of Agriculture, and the State Nursery Inspector. This committee considered all general plans for the work. The direction of the work was left to the State Nursery Inspector, who in turn delegated most of the work to his chief assistant, Charles Fernald, 2nd.

Owing to the widespread distribution of the disease as determined in 1916, in Massachusetts, it was evident that trained crews could not be obtained in sufficient numbers to thoroughly cover the state, and also it was thought desirable to have as many local men as possible educated to recognize the disease and to learn the methods for its control. Therefore, the state was divided into eighteen districts, each in charge of a superintendent who was assigned the duty of selecting a good man in each town and training him for this work. The local man was to put in as much of his time as necessary to cover the town frequently, removing all diseased Ribes whenever and wherever found, and in the case of large towns, or where the abundance of Ribes rendered it necessary, he was to employ help to enable him to cover the town at least once a month and, if possible, every two weeks.

In the eastern part of the state an organization existed for gypsy moth work, consisting of division superintendents with well trained men under them in each town. It seemed advisable to incorporate this organization in the blister rust work, only two disadvantages being evident, viz., that these men might be busy a part of the time with their regular work and that the superintendents would need training for their duties. Accordingly a trained superintendent was sent with each of the gypsy moth superintendents, who educated the latter to recognize the blister rust and to a knowledge of the control methods. As soon as the superintendents in the eastern part of the state were trained, the trainers were transferred to the western part of the state and assumed charge of the districts in that region. These men had to visit every town, select a good man for the work, train him to know the disease, etc.

The appropriation became available only on May 17, and considerable time was consumed in this preliminary work, so that it was practically the first of July before much real work was started, although by the 15th of June several of the first men trained in each district were at work. It was so late in the season that very little work could be done upon pines, and on June 25th an order dated July 5 was issued to turn to Ribes work.

A total of 596 men were on the pay roll in Massachusetts in 1917, but some of these were employed merely as laborers, for a few days. About 350 names were regularly on the payroll. Labor conditions and the war had a serious effect upon the work. Six

of the superintendents and two of the office force entered military service during the season. This caused a combining of districts, a shifting of men from one kind of work to another, and produced temporary breaks in the work. Had it not been for the war, and dissatisfaction at the reduction of the time to be put on the work, and by failure of the Federal Government to pay wages promptly, (86 men were lost from this cause alone), the average number on the pay roll would probably have been about 400.

Among other causes leading to unsatisfactory progress of the work in Massachusetts was delay in obtaining copies of the law to put in the hands of the men, which resulted in failure to remove diseased plants, as the men had nothing to show which would establish their right to remove such plants. Also one of the conditions of cooperation by the Bureau of Plant Industry was that demonstration control areas should be established, in and around which all Ribes should be removed, whether diseased or not. The establishment of these areas was not undertaken until August 1st, after the general State work had been gotten under way. To do this work rearrangements became necessary, and resulted in cutting down the time spent on the work in many of the towns. Many of the local men objected to working as little as one day per week, claiming that they must have regular work for at least four or five days or they would be obliged to do something else. The committee recognized the validity of this claim but circumstances relating to the cooperative agreement

were such that little could be done and work was reduced to a minimum in nearly two-thirds of the towns of the state, in order to prosecute the eradication work.

On this plan therefore, the work has proceeded since the first of August. Every town has been covered for cultivated Ribes at least once, and most of them several times, and all diseased plants taken out and destroyed. In addition, places where disease has appeared have been frequently revisited to make sure latent cases appearing subsequently should not escape. As a part of the inspection, a census of all cultivated currants and gooseberries has also been taken. Undoubtedly some have been overlooked, but from check counts made here and there it seems probable that 85 to 90% of all the cultivated Ribes in the state have been enumerated. The knowledge thus obtained should be very useful for any later work besides indicating quite definitely the importance of this industry in Massachusetts.

The work in 1917 resulted in finding a total of 94 pine infection centers in 55 towns. Including last year's results, infected pines have been found in 72 towns, out of the 352 towns in the state. Rather serious native pine infection areas were discovered in the towns of Pembroke, Topsfield, Rowe, Charlemont, Sandisfield, Greenfield, Bridgewater, and smaller areas in a few other towns. Infected Ribes were found in 224 towns. In 110 of these there were infected bushes on from 1 to 5 properties; in 56 towns infection centers numbered from 6 to 15, and in the remaining towns there were more than 15 separate Ribes infection centers in each town. Forty-one towns where the disease occurred

last year were found to be free from disease this year, and diseased Ribes were found in 56 towns from which none was reported in 1916.

Five Ribes eradication areas were established and work began August 1st for the first one and at later dates for the others as arrangements for the work were completed.

1. Ipswich area: This area includes portions of the towns of Ipswich, Topsfield and Hamilton. About 40 square miles were worked in 1916 and approximately $\frac{2}{3}$ of this area was reworked in 1917. About 50,000 wild Ribes were removed this year, of which about $\frac{1}{4}$ were diseased. It is impossible to separate the cost of this work from the cost of the work in adjacent towns. However, in Topsfield about 1800 acres were eradicated at a cost of about \$1.00 per acre.

2. Lennox, Stockbridge area: In this area about 5,120 acres were eradicated for the second time (first time was in 1916) at a cost of about 24¢ per acre. Approximately 18,000 wild Ribes were removed, about 50 per cent of which were infected. In addition many cultivated Ribes were destroyed.

3. Warwick area. This area comprises the entire town of Warwick which contains 22,300 acres. 14,000 wild Ribes and about 1,150 cultivated Ribes were destroyed. Of these 350 wild and 2 cultivated bushes were diseased. Eradication on this area cost about 10¢ per acre. Over 80 per cent of the wild Ribes were found as indicated by check plots.

4. Athol area. This area comprises the towns of Athol, Petersham, Barre and Dana.

In Dana, eradication was completed over the entire town, which contains 11,189 acres. 15,000 wild Ribes and 1,018 cultivated Ribes were destroyed. Of these, 30 wild and 12 cultivated bushes were infected. $\frac{3}{4}$ of all the wild Ribes found were skunk currants. Eradication cost approximately 9¢ per acre.

In Athol, about $\frac{4}{9}$ of the town was eradicated. In this area 35,000 wild Ribes and 4,384 cultivated Ribes were destroyed, 200 wild Ribes and 11 cultivated were infected.

Eradication cost about 29¢ per acre for this area. Wild Ribes were found in the following proportions: Black currant 1/4, red currant 1/4, and skunk currant 1/2. In addition, 300 acres of pine were scouted without finding any disease.

In Petersham, 1/5 of the area of the town, or about 4,000 acres, was covered. In addition, 500 acres of pine were scouted but no disease found. 30,000 wild Ribes and 1,420 cultivated Ribes were destroyed. Of these, 20 cultivated bushes were infected. Eradication on this area cost about 42¢ per acre.

In Barre, Ribes on 3,680 acres were eradicated and, in addition, 800 acres of pine were scouted without finding any diseased pine. 10,400 wild Ribes and 5,050 cultivated Ribes were destroyed. Of these, 150 wild Ribes, and 13 cultivated, were diseased. 80 per cent of the wild Ribes were gooseberries. Eradication cost about 46¢ per acre.

5. Halifax area. This area consists of the towns of Hanson, Halifax, Hanover, Pembroke, Marshfield and Duxbury. Cultivated Ribes only were eradicated in these towns. This area was selected because of the abundance of infection on pine and Ribes, importance of white pine growth, scarcity of wild Ribes, and because the region is to some extent occupied by residential estates, giving the pine an added value. The report on the eradication work in these towns has been delayed and is not available.

Considerable difficulty was encountered in conducting the demonstration control work because labor was hard to get and harder to keep under existing methods of payment. In at least two cases, crews were turned out of their lodging places because they could not pay their bills, and had no money with which to live. Though a Federal Paymaster was located at Amherst so that bills could be paid promptly, the working of this was entirely nullified by failure at Washington to keep him supplied with money. Several times he was entirely without funds during periods varying from one to about three weeks, and much

of the remainder of the time the amounts sent him were only enough to pay a part of the bills. Such management is not economical and decidedly not efficient; in fact it is disgraceful and would not be permitted by any private business concern. Crews varied in number from five or six or more to one or two men at times, as men got disgusted and left the work, and new ones had to be hunted up to take their places, trained and taught how to work, only to have them leave in their turn after waiting two or three weeks for their pay.

Two nurseries have shown the presence of blister rust this year, viz., American Forestry Company and the North Wilmington Nursery, both under quarantine.

The State expenditures, to November 30, 1917, were as follows:

	<u>State</u>	<u>Expenses</u>
Administration	\$1024.13	\$1951.73
Supervision	652.25	6463.86
General control	7816.64	9705.04
Demonstration control areas	\$8470.05	
Education		<u>244.45</u>
Total expenditure	\$36,328.15	

Under present war conditions in Massachusetts; the necessity for keeping a large force on the work, and the expense of this, it is the opinion of the State Nursery Inspector that it would probably be unwise at the present time to attempt anything like state wide control of the disease, and that the best

policy to pursue is to select the most valuable pine-growing areas in the state, make them eradication areas, and remove all Ribes, wild and cultivated in and around these areas for a distance of at least one mile from the outside of the areas themselves. This should be done, if done at all, for at least a five year period, as only in this way can complete eradication of the Ribes be secured.

Rhode Island: Scouting this year revealed 45 places having Ribes infections, scattered throughout the state, and three infected pine plantations, one near Newport, and two at Westerly. Owing to the lateness of the season (September) when scouting was started, it was impossible to finish this work, although about one half the state was covered quite thoroughly.

It was hard to obtain good men due to scarcity of labor, but the draft did not affect any of the men. The best sized crew consisted of six men and a foreman.

A control area was located at Greene, town of Coventry, and is approximately 5 by 2 miles or 10 sq. miles. The land is comparatively level; 15 per cent is cleared, the remainder being woods and brush, bearing a stand of white pine valued at \$155,000. An average of 3 wild gooseberries to every 4 acres were found in the Summit half of the area, 1% of which were diseased. *R. hirtellum* or *cynosbati* was most common, although a few wild red currants were found. A total of 3,438 wild Ribes and 951 cultivated Ribes were removed, of which only a total of 8 infection points (wild and cultivated) were found. A total area of 8,236 acres was covered in eradication, at an aver-

age cost of 34 cents per acre.

At first people were skeptical about ^{the} need and value of the work. As the work progressed, literature was distributed and the people became interested and as a rule favorable to the work. Practically no opposition was offered in the removal of cultivated Ribes and only a few of the people requested compensation for destroyed bushes.

Outside of the distribution of publications very little educational work was attempted, except to have the men interest and favorably impress the public.

An attempt was made to promote private eradication among wealthy owners of pine land and they responded exceedingly well. Very little was accomplished owing to the lack of a man to follow up and push the work. To be successful one man will have to give his entire time to this type of work.

The state spent a total of \$1,432.65 to November 1, of which \$112.75 was compensation for cultivated Ribes destroyed. The work was supervised by George E. Spencer and Ralph A. Sheals, under the direction of the State Nursery Inspector.

The following recommendations are made:

1. Eradication work should be started early in the spring and continued until late fall. Each type can thus be covered when it is most easily accessible and Ribes are most easily seen.
2. A type-map of the area to be covered should be given the crew foreman at the beginning of the season's work.
3. Each crew foreman should be given an outline of the data he should obtain during the season.
4. Encourage private cooperative eradication, the State or Government giving assistance in the form of supervision and ad-

vice as to methods, organization, etc.

5. Residents within a control area should be shown specimens of the disease, given literature, their interest aroused and cooperation secured as far as possible before the actual work of eradication begins.

Connecticut: In 1917 Ribes infection was found scattered over the state. The aecial stage appeared April 17th; the uredo June 13th and the telial July 31st.

The crews, equipped with Tords, inspected all pine plantings during May and June, beginning May 7th. Eradication work was started at Norfolk May 12 by two crews. The state was divided into districts and a scout assigned to each, whose duty was to watch for Ribes infection and obtain the interest and cooperation of the people. This branch of the work began June 17th.

Eighteen forest or ornamental plantings were found diseased, ten of which were previously unknown. Two plantings and one nursery diseased last year were apparently clean this year. No nursery infections were discovered. The most extensive new pine infection is located at Pomfret where several twenty year old trees were found diseased and cultivated Ribes in the vicinity were heavily infected. An attempt to organize cooperative eradication in this region will be made next year. Infected Ribes were found at 93 places in the state, outside of the Norfolk region. A control area of ten square miles was selected at Norfolk because Ribes were partially eradicated there in 1916 and there is good native white pine growth with numerous wild Ribes.

Native pine infections were found in isolated groups throughout the control area, but not to any great extent outside of it. Ribes infection was general in 1916 and 1917.

Camps for the crews were successful. Six men and foreman, using staff compass and working 6 to 8 feet apart seemed to be the best method of work. The first six weeks were spent in scouting 600 acres of pine at an average cost of \$1.80 per acre. About 3000 acres were covered for Ribes at a cost of about 85¢ per acre. Not over 1% of the pine showed infection, although in a few limited areas infection ran as high as 75%. It was found to be too expensive to eradicate diseased pine.

No accurate data was kept on number of Ribes destroyed but they were very abundant in swamps. On hardwood ridges containing hemlock there was practically none. The kinds of wild Ribes in their order of abundance is as follows: *R. cynosbati* var. *glabra*; *R. oxycanthoides*; *R. vulgare*; *R. prostratum*; *R. nigrum*; *R. aureum*; *R. americana*. 50 to 60% of all Ribes found were diseased. At least 75% of the Ribes were removed from the territory covered. In many sections the percentage was much higher. No plots were gone over twice, so a check on the percentage removed was not obtained.

Eighty per cent of the cultivated Ribes in the control area were diseased and no opposition to their removal or request for compensation was encountered.

There are about 200,000 acres of commercial pine in Connecticut, and about 3,000 acres were eradicated this year. At

this rate it would take 50 years to finish eradicating Ribes in the state, once over. There is good reason to believe private cooperative eradication can be developed to a considerable extent.

No large commercial Ribes plantations exist in the state but in the southern part of the state there are several 1 or 2 acre commercial currant growing areas. The pine in that section is not commercially important, so the state will probably be divided into sections where value of pine will require the prohibition of Ribes; others where pine can only be grown at great risk, and currant growing districts defined.

Education was carried on by publications and a poster, by illustrated lectures, and by personal contact of the scouts. In general, the attitude of the public is very good. No effort to enlist ^{the} aid of county agents, boy scouts, school children, etc., has been made.

All of the 32 men employed were college men, and no difficulty was experienced in obtaining them although labor was scarce. Three enlisted in the army, one in the navy, one went to Plattsburg and four were drafted. The state spent a total sum of \$7,423.67 in 1917, to November 1. The work was supervised by A. E. Moss, under the direction of the State Forester.

New York: The plan for blister rust work in 1917 was as follows:

1. Reworking last year's barrier zone in Columbia County.

2. Establish a barrier zone west of infected area in Essex and Clinton Counties.
3. Establish a barrier zone along Niagara River, duplicating mile wide Ribes-free zone along Niagara River in the province of Ontario, to prevent spread of disease into New York State.
4. Scout the entire state to obtain more complete data on distribution of the rust.

Scouting on pine was continued from April 5 to July 1, while Ribes scouting was carried on from July 1 to October 31. Two methods were followed, general and intensive. The former consisted of using an auto and stopping every mile or so to examine cultivated Ribes. Intensive work was carried on by assigning a man to a designated territory to scout on foot. As a rule the best plan is general scouting, searching especially for cultivated black currants, followed by intensive scouting in localities where the disease is found.

Scouting in the vicinity of ^a/diseased area was more intensive than in other places. A total of 29 men were employed in scouting, but not more than 20 were in the field at any one time. Scouting native pine was unsatisfactory. Native pine infections were found along the road between Lewis and Pocomoonshine Mountain, Essex County, for a distance of six miles; also near Harkness, Anthony's Nose, North Hudson and Gloversville. The infected pines at the two places last mentioned were found in the vicinity of pine plantations. Infected

planted pines were found in nine places as follows:

1. Finch, Pruyn Lumber Co. - North Hudson.
2. Gloversville Water Works - Gloversville.
3. Great Bear Spring Water Company, Fulton.
4. Paragon Plaster Co. - Forestport.
5. A. G. Lewis - Geneva.
6. State Plantation at Mountain Pond near Paul Smith's, N. Y.
7. State Plantation at Boulder Cut, between Lake Clear Junction and Saranac Lake.
8. Bradley Martin - Westbury, L. I.
9. Ornamental trees on estate of Mrs. G. H. Lewis - Geneva.

Wild Ribes occur all over the State in more or less abundance. They have been eradicated in the vicinity of pine plantations and nurseries.

The largest demonstration Ribes eradication area was located in the vicinity of Lewis, Essex County, and comprises an area of 11,900 acres. The topography, in general, is very rough, and there is much wild forest land. Ribes were found heavily infected all over this area and diseased pine trees occur over an area of from 20 to 30 square miles in this region. It was selected because it is the largest area of native pine infection in the state, and wild Ribes (principally gooseberries) are exceedingly abundant. Some of the best native pine in the state is in this region.

On a ten acre sample plot in the Lewis control area, wild gooseberries were found as follows:

1st time covered -	2981	wild	gooseberries	-	cost	\$21.00
2nd " "	150	"	"	"	"	18.50
3rd " "	32	"	"	"	"	16.00
			Total cost			<u>\$55.00</u>

Average cost per acre for the three eradications \$ 5.55

Average cost per acre for 1 eradication 1.89

One 10 acre plot at Deerhead netted 1,624 gooseberry bushes, while on another of 20 acres 2,824 gooseberry bushes were found.

Expenditures, Essex County Eradication Area

Area	:Super- :vision	:Ex- :penses	:Labor	:Sup- :plies	:Compen- :sation	:Total :Cost	:Area :Acres	:Cost :per :Acre
Deerhead:	344.00:	272.19:	2747.38:	1093.52:	:	4457.09:	2950:	\$1.51
Reber	:195.00:	:86.56:	:1428.25:	:690.43:	:	:2400.24:	:2400:	:1.00
WarmPond:	60.00:	91.99:	3392.00:	16.98:	:	3560.97:	2100:	1.70
Coopera- tive work	:60.00:	:174.80:	:644.75:	:78.12:	:	:957.67:	:4450:	:.22
Eradica- tion Cul- tivated currants:	:60.00:	:282.88:	:61.00:	:	:1559.09:	:1962.97:	:	:.16
Total	:	:	:	:	:	:	:	:
Essex Co:	719.00:	908.42:	8273.38:	1879.05:	1559.09:	13338.94:	11900:	:
Average per acre								\$1.12

Another demonstration control area was established in Clinton County because of the abundance of young white pine, because no pine infection has been found and Ribes infection was prevalent; and also because local labor was available. This is in an agricultural section, and the land is practically level.

Data on 10 acre sample plot laid out within the area was as follows:

1st time covered - 21 wild Ribes
 2nd time covered - no wild Ribes) Total cost \$4.86
 3rd time covered - no wild Ribes) Average cost - 49¢ per acre.

Data on another 10 acre plot within the same area:

1st time scouted - 18 wild Ribes
 2nd time scouted - 1 wild Ribes) Total cost \$3.93
 3rd time scouted - no wild Ribes) Average cost -.39¢ per acre.

The average cost over 4,000 acres in this area was .23¢ per acre.

A smaller control area of 2,120 acres is located in Washington County and is similar to the Clinton County area, although Ribes were more abundant. Eradication cost in this area averaged 25¢ per acre.

A two mile wide barrier zone was started in Essex and Clinton Counties in the spring of 1917. The purpose of this zone was to surround the area of heavy infection centering around Lewis, but in late July infected pine and Ribes were found west of the zone so the work was discontinued. The Essex County eradication area will probably be extended in 1918 and later years so as to connect with this barrier strip. This strip includes a total of 23,384 acres from which the cultivated Ribes and part of the wild Ribes were removed. The total cost averaged 13¢ per acre, including compensation for cultivated Ribes, which totalled \$2,918.20.

In the barrier zone in Columbia County, (a strip about 2 miles wide), 66,165 wild Ribes were removed from 7,124 acres at an average cost of 11¢ per acre. In this same area 12,209 cultivated Ribes were destroyed for which the compensation amounted to \$2,705.35.

In the Niagara barrier zone, 13,376 acres were eradicated at an average cost of .46¢ per acre. 40,385 wild Ribes and 8,361 cultivated Ribes were destroyed on this area. Compensa-

tion for the latter amounted to \$4,040.82. Out of 37 infections, only one case was found which was not associated with black currants.

Commercial currant growing centers in New York are located on the east side of the Hudson Valley ^{the} in/vicinity of Germantown; on the west side ^{the} of/Hudson Valley from Newburgh to Kingston; in the vicinity of Geneva and Rochester (Nurseries); and around Lockport and the region bordering Lake Erie in the counties of Erie and Chautauqua. Very little white pine is found near currant growing centers. The state law specifies that the boundaries of commercial currant growing districts shall be determined by the Conservation Commission and the State Department of Agriculture. In these areas all five leaved pines, and all diseased Ribes may be destroyed by the Conservation Commission.

Nursery inspection is in the hands of the State Department of Agriculture, who cooperates with the Conservation Commission, which has jurisdiction outside of nurseries. Diseased Ribes were found in the following nurseries in 1917:

C. W. Stewart & Schifferli, Fredonia
 T. S. Hubbard Nursery Co., Fredonia
 T. S. Hubbard Nursery Co., Silver Creek
 Brown Brothers, Rochester
 Green Brothers, Chili
 Gilbert Costich, Rochester
 Nelson Bogue, Batavia
 Edgar Empie, Sharon Springs
 F. A. Guernsey & Co., Schoharie

In these nurseries 50,029 Ribes bushes were destroyed, entire blocks being burned when diseased bushes were found in

them. No diseased pines were found in nurseries. \$522.63 was spent in the inspection of pine and Ribes near Geneva.

Twenty thousand colored mailing cards were sent to pine owners in the state and given to all land owners in infected districts. Publications were distributed and 25,000 colored posters were printed, but no effort was made to enlist the aid of County Agents and other established organizations.

The people in control areas objected to the removal of their cultivated Ribes and did not consider the destruction of the wild ones of any value. Their attitude is changing and several associations of owners of white pine timber will probably cooperate in controlling the disease next year.

Eight men either enlisted or were drafted. It will probably be impossible to get many of this years' men next year, and the draft may be felt more.

The cost of blister rust work in New York to November 1, 1917, was:

Salaries - - - - -	\$10,460.54
Expenses - - - - -	19,309.64
Compensation for cultivated Ribes- - - - -	<u>16,523.29</u>
Total expenditure of state funds - - -	\$46,293.47

An emergency appropriation is being asked of the legislature to cover part of the cost of this work, since the appropriation for 1917 was only \$25,000, with \$3,000 additional from the State Department of Agriculture for blister rust infections in nurseries. The cost of compensation for cultivated Ribes

destroyed in control work totalled \$16,523.29 for bushes, or an average rate of cents per bush. The New York law requires owners to be recompensed at values which are set by the Commissioner of Agriculture, and the law makes no exception for diseased cultivated bushes destroyed. The following is the rate of compensation set by the Commissioner of Agriculture in 1917:

CURRENTS AND GOOSEBERRIES

*Fruiting plants of black, white or red varieties in a good state of cultivation and care four years or over 50¢ each plant. (Same on gooseberries 50¢ each).

Fruiting plants of black, white or red varieties in a good state of cultivation and care two to four years 35¢ each plant. (Same on gooseberries 35¢ each).

Fruiting plants run down, depreciated by age or lack of recent care (reference had to plants capable of rejuvenation) 25¢ each plant. (Same on gooseberries 25¢ each).

Good plants, but neglected, unpruned, in sod and uncultivated, 10¢ each.

Nursery stock of currants

1 year	first class	1½¢ each
1 "	second class	1¢ "
* 2 "	first class	2½ to 3½¢ each
2 "	second class	1¢ each
Stool plantations		50¢ each (if fine)
"	" seconds	25¢ each

Downing and Smith's Gooseberries

First class	2 year at	5¢ each
" "	1 " "	3¢ each
English varieties at		12¢ each

* Under the items indicated by a * certain cases may arise where the appraised valuations indicated should be further considered, reference being had to new varieties of currants and gooseberries. In the case of two year old, first class graded currant bushes the appraisal should be as high as thirty or thirty-five dollars per thousand.

The following recommendations are made:

1. Place work on individual cooperative eradication basis and see that it does not lapse after a year or two.
2. Quality of crew work depends on personality of foreman.
3. Count bushes pulled to stimulate interest of the men.
4. Reeradicate a check plot each week. Should get 90% of Ribes the first time over the ground.
5. Alignment of crew should not be given too much consideration. Men are working, not drilling.
6. When a patch of skunk currants are found, put entire crew to pulling them out by working close together, then resume former line.
7. Follow contours in covering steep ground.
8. Best size crew for Adirondacks seems to be 8 men with foreman.
9. In pulling Ribes bushes a box hook has been tried with success. By catching hook at base of bush, a hard, firm hold is obtained.

Pennsylvania: Work in this state was confined to scouting for diseased pine and Ribes. A total of 2,202,425 planted pines and 246 acres of native pine were inspected. Also 85,000 Ribes were inspected. As a result diseased pines were found on two estates in Berks County, near Reading; in Cambria County, in the Cambria Coal and Mining Company's plantation; in Clarion County; at Foxburg; and in Montgomery County, near Springhouse.

Nine suspicious Ribes bushes^{were} destroyed. In no case could any evidence be found that the disease had escaped or established itself in the State. There were four men employed in scouting in Pennsylvania from May to November, 1917, and the state spent a total of \$3,605.82 to November, 30, 1917.

New Jersey: Thorough scouting in the northwestern part of the state resulted in the finding of several unknown pine plantings and many wild Ribes. Hitherto wild Ribes were considered as practically nonexistent in New Jersey. About 18,000 cultivated Ribes and more than 30,000 planted pines were inspected. No diseased Ribes were found in the State. Diseased pine were found in two nurseries (Bobink & Atkins and J. R. Brinley's) out of the seven which were infected last year.

The State Nursery Inspector and his assistants spent considerable time inspecting for blister rust during the spring and summer. Two agents of the Bureau of Plant Industry scouted in the state from May to September, equivalent to the time of one man for four months.

Maryland: Blister rust work in Maryland was conducted by Mr. E. R. Ford, ^{from} May 25 to August 23, under the direction of the State Forester. The inspector visited 66 towns in 14 Counties; about 110 properties were inspected including all known pine plantations within the state, and all nurseries growing 5-needle pines. A total of 633,739 5-needle pines were inspected. In addition, a total of 4,966 Ribes were examined, most of these occurring at places which were examined for pine.

During the last five years only a few shipments of white pine have come into the state with the exception of the year 1917. Last year 12 shipments were received from other states totalling 3,408 5-needle pines, 2,659 of which came from the American Forestry Company, in Massachusetts, where the disease

was found this year. Thirteen shipments, totalling 1,044 5-needle pines, were received from the Biltmore Nursery, Ashville, North Carolina.

The Baltimore Customs House records from 1900 to 1913 were obtained through the Bureau of Plant Industry, and all shipments of nursery stock traced and examined as far as possible. No trace of the blister rust either on pines or Ribes could be found within the state.

Virginia: Scouting for the white pine blister rust in Virginia began on May 15, and ended August 30. The work was carried on by the United States Department of Agriculture in cooperation with the Virginia State Nursery Inspector. Mr. A. B. Moore was employed to do the inspection work. He visited about 288 properties, examining a total of 3,800 Ribes and 6,745 5-needle pines. In no case did he find any signs of blister rust infection.

Wild Ribes were observed at Luray, Hot Springs, Basic and Mountain Lake. The following species occur in Virginia, viz. *R. cynosbati*, *odoratum* and *glandulosum*.

Planted pine and Ribes occur in all parts of the state, while native white pine is found in small quantities in, and west of, the Blue Ridge Mountains.

West Virginia: The blister rust work in West Virginia was carried on by the United States Department of Agriculture in cooperation with the West Virginia Experiment Station. Work was begun by Mr. A. K. Perry on July 1, and discontinued Nov-

ember 30.

Practically no virgin white pine exists in West Virginia, but good stands of second growth occur in the south central and eastern sections, and scattered trees are to be found throughout most of the remaining territory. No commercial plantations of white pine of any importance have been made in the State. Two ornamental plantings, totalling 270 trees, are considered most important and should be inspected another year, as the trees came from the American Forestry Company, and D. Hill Nurseries.

Wild Ribes are comparatively scarce, but some species, including Ribes cynosbati, rotundifolium, and Prostratum, are found along and adjacent to the Alleghany Mountains. Cultivated Ribes are of little importance, but a few bushes can be found in about 1/3 of the gardens in the state. The Gold Brothers and C. S. Walker Nurseries are the only ones handling Ribes. The former has about 4,000 bushes and the latter, 175. No record or trace of any imported white pine could be found.

Forty-seven properties were inspected. A total of about 4,930 cultivated Ribes and about 2,206 5-needle pine were examined. No blister rust was found in the state.

North Carolina: Scouting for the blister rust was performed in North Carolina by Mr. P. V. Siggers, a former member of this office, from June 6 to July 23. Most of his time was devoted to the Counties of Buncombe, Watauga and Macon. About

105 properties were visited, and a total of 1,134 cultivated Ribes and 37,533 white pine were inspected. In addition a large number of pine on the Vanderbilt estate were examined and 45 acres of native pine scouted. No blister rust infection was found in the State.

Two species of wild Ribes were found to a limited extent in the mountainous section of the State, namely Ribes rotundifolium and R. cynosbati. Cultivated Ribes are of little importance and only a very few are grown in the state.

Georgia: White pine grows native in the following counties in northern Georgia: Rabun, Towns, White, Union, Fannin, Gilmer, Lumpkin, Murray and Habersham. Trees occur as scattered specimens preferably on sandy soil near streams all through the section of the state that lies between Talullah Falls and the Oostanaula River in Gilmer County. The section of Georgia where white pine is native is non-agricultural and thinly settled. The inhabitants have never imported ornamental nursery stock. Ribes are cultivated to a smaller extent than in the adjoining North Carolina counties.

A day was spent in Atlanta searching for ornamental white pines. Except for 500 in a commercial nursery, none were found. A field agent of the Bureau of Plant Industry spent about ten days in scouting in the state in 1917. A total of 611 pines and 100 Ribes were inspected, and no disease found.

Blister Rust Work in the North Central States.

Tennessee: An inspection was carried out in 1916 by a Federal agent but few plantings of white pine were located. Two nurseries, which handled white pine, were inspected.

In 1917, two Federal agents spent 20 days in the state running down all of the known white pine plantings. 964 five needled pines and many Ribes bushes were examined at 19 places located in 5 towns and cities. No signs of blister rust were found anywhere in the state. Most of the pine shipments are from a North Carolina nursery. Only 1 shipment was located from an infected Massachusetts nursery.

The work in Tennessee was carried on in cooperation with State Entomologist, G. M. Bentley.

Kentucky: In 1916, inspections were carried out, by the State Entomologist, Professor H. Garman, in all the nurseries in the State; and by a federal agent in all of the private plantings of white pine then known. Thirteen inspections were made by the latter, which included two nurseries, handling white pine.

In 1917 two federal agents were engaged in a survey for the blister rust; 37 inspections being made in 11 towns and cities. The time spent in the State amounted to 30 days for 1 man. Most of the plantings known are in the vicinity of Frankfort, Lexington and Louisville. Six nurseries were found handling white pine.

No specimens of the blister rust have ever been collected in Kentucky.

A number of shipments of white pine have been made into the state within the past few years from a large forest tree nursery in Eastern Massachusetts (which latter, has had the blister rust in 1917), and from Pennsylvania nurseries in which the rust had previously been found.

The State Entomologist does not have the power to place a quarantine to protect the state from injurious insect or fungous pests.

Ohio:- Prior to 1917, the disease had been found at two nurseries in the State, one at Painesville and the other at Akron; while a third nursery at Winona was known to have had the blister rust and to have shipped out diseased pines to a Long Island nursery. In 1917 the Federal Government in cooperation with the State Nursery Inspector carried on an extensive survey of the state, examining white and other five needled pines in plantations, nurseries, and private plantings, and Ribes whenever in close proximity to white pines. Seven men were employed in the state by the government for varying periods of time; the total number of days being equivalent to 385 days for 1 man.

Of 444 inspections in 140 towns and cities, made by the Federal inspectors, at only one place was there any

blister rust located, and that on two small white pines at a nursery near Cuyahoga Falls. This nursery had imported 1000 trees from a large Minnesota nursery in 1915. All of the white pines living in this lot at Cuyahoga Falls were destroyed in September, to the number of 662. A search for the disease on Ribes in the vicinity of the infected pines failed to reveal any rust.

Special attention was paid to tracing leads; that is shipments of white pine from infected nurseries.

Indiana: The blister rust was found by Benjamin W. Douglass, Indiana State Entomologist, in 1910, on a shipment of white pines from Europe to the Princeton Nursery at Princeton. The whole lot of pines was destroyed at once. No disease has since been found in the state.

In 1917, the first survey specially for blister rust was carried on by four men employed by the Federal Government who scouted the state at various times during the summer tracing shipments of white pine over the whole state. Their time in the state amounted to one and one-half months for one man.

Inspectors for the State Entomologist have inspected the nurseries for the blister rust, on both pines and Ribes, ever since 1910.

Cooperating parties were the State Entomologist and the U. S. Bureau of Plant Industry.

Illinois: No blister rust has ever been found on white pine or currants and gooseberries in this state. However, the blister rust found on German grown white pine at St. Croix Falls and Amery, Wisconsin, and Taylors Falls, Minnesota, in 1916 has been traced to a large forest tree nursery in Illinois which imported the white pines from J. Heine of Halstenbek, Germany, in 1908 and 1909.

All nurseries handling white pines and all private plantings of white pine in the state that were known were scouted for the blister rust either by agents of the State Nursery Inspector's staff or by one of the five Federal agents. The time of the five men in the state amounted to $5\frac{1}{2}$ months' work for one man.

Little publicity work has been carried on in the state. Farmers' Bulletin #742 on White Pine Blister Rust was sent all owners of white pine in spring of 1917.

Michigan: As it turned out the work was largely a scouting proposition. Inspections were made in practically all parts of the State where white pine, currants or gooseberries, had been planted. Two inspections were made, the first during May, June and the first part of July, to cover plantings of white pine and native pine in the immediate vicinity of white pine plantings; the second to cover all currants and gooseberries, both cultivated and native, in the vicinity of white pine plantings and extensive plantings of currants and gooseberries. In addition to this, inspec-

tion of currants and gooseberries were made in all parts of the State where there is enough cultivation or population to warrant the belief that the blister rust by any chance might have been introduced. In general, at least one inspection per township was made. In some sparsely settled sections, which are not readily accessible, very few inspections were made. In thickly settled regions where many white pines and currants and gooseberries have been planted, as well as along the St. Clair and Detroit Rivers, where there might have been an infection from Ontario, more careful scouting was done and many inspections made.

The work of inspection was directed by Professor L. H. Pennington, who, with nine assistants, had headquarters at East Lansing, and cooperated with the State Nursery Inspector.

Various means of travel were used in scouting for the blister rust. In the Southern part of the State where railway facilities are fairly good, the steam and electric railways were depended upon chiefly. These had to be supplemented by the occasional use of an automobile, horse and buggy, or bicycle. Where wagon roads were fairly good the most efficient combination seemed to be the railway and bicycle. In the Northern counties where the railway service is poor, the rather frequent use of automobiles was found to be most effective. The item of expense for automobile hire was large in some instances but it was fully justified by the time

saved and the increased efficiency of the scouting.

Although there is little white pine forest left in Michigan, individuals and groves of white pine are widely distributed over the state. In the West side native pines are found along the entire Lake Michigan shore; in the East they extend several miles below Port Huron. In the "thumb" section, comprising Huron County and the larger part of Sanilac, Tuscola and Lapeer Counties, there is relatively little pine. On the other hand, some native white pine is found in Munroe County in the extreme southeastern part of the State. In the extensive hardwood forests and swamps in the North occasional white pines are found. It may be said that there is native white pine in every county in the state. The white pine has been so generally transplanted as an ornamental tree in cities, towns, cemeteries and even about farm houses that it is possible to find large white pine trees in every part of the State.

Cultivated currants and gooseberries are found in nearly every community. The flowering currant is found in all the larger cities and in some small places and country districts. In the fruit belt in the Western part of the State are many plantations of currants and some gooseberries. Throughout the southern part of the state the wild gooseberry, *Ribes cynosbati*, is found in woodlots, along fences, and in waste places, and the black currant, *Ribes floridum*, is rather generally distributed in low ground and swamps. In the North the smooth gooseberry, *Ribes oxycanthoides*, gradually re-

places the *Ribes cynosbati*, and the Swamp Black Currant, *Ribes lacustre* (Pers.) Poir, is rather common in the swamps. Almost the only places without currants and gooseberries are burned areas between swamps and streams.

It is evident from the records that by far the largest number of importations of five-needle pines were received by Ferrand & Son's Nursery. No less than seven lots of five-needle pines have been imported by this nursery. Accordingly the pines in the nursery were inspected early in May. None of the living trees showed evidence of infection. One dead stump of a tree in the nursery showed evidence of blister rust canker and in the woods at the edge of the nursery were several dead trees which had been removed. These trees showed that the rust had fruited abundantly in 1916. Mr. Ferrand said that as many as a dozen diseased trees had been removed during the past five years. As there were many plants of the wild gooseberry (*Ribes cynosbati*) near these white pines, not over thirty feet distant, secondary infection might have occurred. Wild black currant, *Ribes floridum*, also was found within 500 feet of the block of pines. Mr. Ferrand was of the opinion that the diseased pines came from Charles Detriche, France. A comparison of the age of the trees with the custom house records of importation indicated that they probably came from Levavasseur & Fils, Ussy, France, in 1908. After consultation with Professor Taft, Mr. Ferrand destroyed all the pines in the block in which all diseased trees had been found.

Professor Taft, as State Inspector of Nurseries and Orchards, placed a three-year quarantine upon all the other five-needle pines in the nursery. The other white and stone pines were from 200 to 600 yards from the nearest currant or gooseberry bushes.

Late in July and again on September 14th these pines were inspected for secondary infections. At the same time all the currants and gooseberries in the vicinity of the nursery were examined carefully. No evidence of pine blister could be found upon the pine or the currants or the gooseberries.

The results of the survey are very encouraging. No infections were found upon living pine or Ribes. Considering the season and the results of infection upon currants over wide areas in Ontario, it is practically certain that if there had been any considerable amount of the rust fruiting in the State some trace of it would have been found upon currants or gooseberries. There are some pine plantings of imported stock which should be watched for a number of years for the appearance of the disease. These are found chiefly in the vicinity of Detroit and in Oakland County. Fortunately, practically all the larger plantings and the great majority of the small plantings have been made with stock grown in the State nurseries which are and apparently always have been entirely free from white pine blister rust. Moreover, in the State Nurseries currants and gooseberries are so few or so far removed that there would be very little danger of pine infection even though the rust were prevalent in the State.

Wisconsin: For the greater part of the season, the scouting was of an intensive nature. The idea in mind was to cover the areas known to be previously infected, with the contiguous areas, and the St. Croix River territory which was accounted as likely to be infected, in such a manner as would turn up by far the greater part of the infections in those areas, with a view to the effective eradication of the disease from the St. Croix district - the only part of Wisconsin as yet known to harbor the white pine blister rust. Most of the work was done from one camp, with the camp machine aiding in the distribution of the men and the hauling of supplies. The work was planned so that the territory from five to seven miles on either side of the camp could be covered, and the camping places were thus ten to fourteen miles apart as sources of supplies, favorable camping sites and such dictated. Later in the season two camps were formed - one to cover the region around St. Croix Falls and the other to work around Amery and Sucker Lake.

The number of men varied from seven or eight to twenty; the men were divided into squads of from three to five; each squad under a leader, and they were assigned areas to work as often as was necessary, in such a way that all the territory should be covered and with the method elastic enough in its working to allow for inequalities in the lay of the land or the amount of pine or Ribes to be inspected. The work was supervised by Walter H. Snell, under the direction of the

State Entomologist. It began May 30 and was ended October 14, 1917.

Later in the season, when it was strongly suspected that the disease might jump more than the generally believed five hundred yards at a single leap and when the infections discovered at Amery led us to surmise that the disease had escaped from Sucker Lake in 1912 - or at least before 1916 - scouting of a more extensive nature was resorted to. There were but four men left in camp at this time and these men worked from headquarters in the machine. Under this plan for the most part the men started at a cross-roads and each man took a section to cover. Or where the woods on both sides of a road gave prospects of good Ribes land, the squad was divided and the two men then assumed responsibility for a portion of that area.

In general, the pine areas scouted in the Sucker Lake - Balsam Lake - Amery portion of Polk County were those within reach of these three camps. The pines around Sucker Lake in all directions, those through the swampy areas east of Sucker Lake (behind the first camp) and along the Balsam Branch of the Apple River to Balsam Lake, those along the Fox River and north of Balsam Lake, and those east and south of Amery were inspected. From Lykens, the State Entomologist and one of the men scouted the pines along the roads in the four-cornered area between the following places - Sucker Lake, Balsam Lake, St. Croix Falls, and Osceola. A squad inspected the pines

owned by Mr. Baker at Deer Lake also.

In the St. Croix River region, the pines were inspected from Wolf Creek north of St. Croix Falls to Prescott in Pierce County, where the Mississippi and St. Croix rivers meet - a distance of about 55 miles air line. The pines were for the most part confined to the banks and bluffs of the river, to the coulees running in from the river, and to the bluffs of the tributary rivers like the Apple, Willow and Kinnickinnic - that is, for the greater part, a narrow strip not more than a hundred yards wide, except where the coulees or rivers are located or where the river has receded and left swampy bottom or cut out islands. The pines do not extend up the Willow and Kinnickinnic Rivers very far, but on the Apple River they are found as far as Somerset and at Apple River Falls (where the St. Paul Power Plant is located - a village going under several names) there is quite a pocket of pines. All pines that could be found near the river were inspected.

In addition, squads were sent at different places into St. Croix County from the Somerset camp to see what could be found; in this way, the territory around Star Prairie, New Richmond, and Jewett Mills was examined for both Pines and Ribes.

The Ribes scouting began on the down river work at Osceola. It covered the St. Croix River bank from Osceola to Hudson for a width of from four to seven miles inland and

included another look at the shores opposite Aften, Minnesota, where an extensive pine and Ribes infection was found early in the season. As has been mentioned, the Ribes in the neighborhood of New Richmond, Star Prairie, and Jewett Mills were examined by various squads. On the northern swing of the camp, the Ribes were inspected from Osceola to a point two miles north of St. Croix Falls and east as far as Centuria, Lamar and east of Dresser Junction, including three trips to Deer Lake. A great deal of time was spent in St. Croix Falls, where the disease was found, inspecting the Interstate Park thoroughly as well as the territory around the town in all directions. The whole region from Osceola north was combed carefully and a number of infections including a pine infection were located on the first trip around. The first few infected areas were eradicated with a view to preventing secondary infections and then one squad was detailed to go over the area again to find and eradicate any infections that appeared since the first round.

During the inspection and eradication in St. Croix Falls, a portion of the camp was detached and a new camp set up at Sucker Lake. The scouting was intensive for the first few days, in order to find out if any infections were cropping out where the eradication had been carried on the previous year; the "island" belonging to Dr. Wallace was inspected carefully as well as the contiguous territory. Infections soon began to be found at the north end of Sucker Lake and to the west,

and it was then seen that the disease had escaped some time before 1916. The scouting was changed in nature to the more extensive sort and the men were sent out to cover wider areas and those less minutely, with the idea of rounding up the limits of the infection and finding the center if possible. Four men scouted portions of the townships of Black Brook, Clear Lake, Clayton, Beaver, Apple River, Balsam Lake, Milltown, St. Croix Falls (around Centuria) in ^{Pell}Pole County and the territory around Turtle Lake in Barron County.

One pine infection was found - that one in St. Croix Falls on some young pines that were given the owner by the late Major Baker in 1913. These pines had had fruiting aecia this spring and possibly the year before.

Thirty-six Ribes infections were found - twenty-four in the St. Croix district and twelve in the Amery-Sucker Lake area. In St. Croix Falls there was one well-defined group of infections which without any manner of doubt came from the infected pines found on the hill near the standpipe. There was another group of infections a half a mile distant which may or may not have had their origin in these pines.

The two southerly infections along the river- at Messrs. Cooper's and Wyman's estates - are directly opposite Minnesota infections - Franconia and Mr. Wyman's estate in Minnesota respectively.

As to the infections in the Amery region, even less is certain from this summer's work. Time was so limited that

the pine centers could not be located. The infections in section 26 of the town of Lincoln and section 36 of Balsam Lake were of large extent - a quarter of a mile or more square in each case; this fact would indicate that the heavy stand of pine in each place bears some infections that had spread the disease to the Ribes.

The outlying infections as found in the late scouting are from seven to nine miles as the crow flies from the original infection at Sucker Lake. One of two things is possible - the disease escaped from Dr. Wallace's in 1912 or 1913 or there are some more primary centers not found as yet.

The Ribes eradication this summer was largely a matter of expediency and was confined to St. Croix Falls; the infections were found comparatively late, labor was exceedingly scarce at first, and the area to be covered was large. Accordingly, inasmuch as eradicating all the area deemed necessary was impossible, a sort of selective eradication was practiced; that is, the squad was set to work wherever it appeared that the greatest benefit would result.

Various methods of disposing the men for eradicating were tried. Squads of various sizes were used, but the large sized squad seemed to give the best results. The four-man squad, with one of the men checking the other three, was not tried, however. The entire 20 men were used in one large squad most of the time. The squad was arranged in three

lines - 11 to 15 in the first line, 6 in the second and usually 3 in the third. Each man in the second line was responsible for the work of two men in front of him and each one in the third line for the six in the two lines ahead of him. The men in the back line had to go back and forth across the general direction taken by the squad, thus adding the feature of checking crosswise.

A checking up on the number of plants pulled by the men in the different lines disclosed these figures: on a given trip one way the men in the first line averaged 15 bushes apiece; the second line 8 or 9; the third 5 to 7. This meant that the second line was missing altogether too many, although most of the bushes missed by the second line were quite small. The assumption naturally was that if the third line could find most of the small bushes missed by the second line, they could also see the larger ones missed by the first line and found by the second. Hence, the second line was abolished - that is, the poorer of the second line men were moved up into the first line, thus widening the strip that could be covered, and the better men were retained to help the third line check up the wider strip. This left two lines of men, 15 and 5 in number as a rule. The best man in the second line was custodian of the flags, marked the limits, and kept the line straight.

One criticism of the long line method was that the line was liable to disruption while some of the men found bushes to pull and others did not - if not disruption, at least delay.

But this difficulty was not experienced; there were no inequalities in the number of Ribes bushes encountered sufficient to cause the line to hold back while some men pulled; on the other hand the steadying effect of the whole line led some of the more superficial searchers to hesitate and pay sharper attention.

In this eradication, the infected bushes were burned at once; if there were large quantities of infected bushes, they were piled in large piles and then burned. A number of men were delegated to do this special work. If the bushes were not infected, they were inverted on stumps, in crotches, or on fence posts to dry out; special care was always taken to see that the bushes were left in places sufficiently dry to insure dessication of the bush, as otherwise rooting would take place.

Figures were taken on the cost and time for two of the pastures eradicated, for comparative purposes. The 20-man squad took one half hour to clean up an acre - the average being taken for the whole pasture of a number of acres; the cost now was \$2.43 per acre (17 men at 25¢ an hour and 3 at 20¢). 134 bushes of all sizes were pulled out, most of them being over 3 inches in height. The efficiency test was carried out by scouts who had had much experience in eradicating and represented the keenest eyes in camp; in an acre picked at random, three of them found 90 bushes - 1 of 12 inches, 8 of 6 inches, and the remainder 2 inches or less in

height. 90 bushes on the check seemed outrageously high on first thought, but it must be considered that 88% of them were 2 inches or less in height and the class of labor available did not get all of those, at least at an economical rate of working. It was found that this was about as good as could be expected - that these High School boys would leave just about this many small bushes to the acre, varying somewhat with the sort of land covered. It was found that it would almost take hands-and-knees scouting to insure removing the small Ribes of 2 inches or less in height.

Van Konynenburg's pasture was a much cleaner piece of ground. The squad of 20 men took 27 minutes to the acre as an average at a cost of \$2.07. The efficiency test resulted in 25 bushes being found - 3 over 1 foot high and the rest 2-6 inches. The pine eradicated was not very extensive. The pines found infected at St. Croix Falls were cut down and burned.

No eradication of pine was attempted at Amery; there were three pines on the property of Mr. Fred Swanson north of Sucker Lake where the cultivated Ribes were found infected, but these were not cut down. It was decided to leave them until a definite policy was determined upon and not to spoil three young and carefully nursed trees until it was found necessary and part of a general policy.

Great care was taken to prevent the spread of the disease by the scouts. Anyone who went from one camp to the other was compelled to change his clothes and to sterilize those worn in the infected area; the clothes worn in the infected area were not allowed outside until properly sterilized, rinsed and dried. The suits were soured in a tub of 7 to 10 per cent formalin for at least a half hour and then rinsed in another tub containing clean water; the thoroughly rinsed suits were then hung out to dry and the extra suit worn the next day while the sterilized one dried.

Articles were given to the papers in some of the towns and they were courteously accepted and printed; while the camp was in St. Croix Falls an article was accepted each week for nearly two months. The papers of Hudson and Amery also gave us space. Farmers' Bulletins were generously distributed in the peregrinations of the men over the countryside; bulletins were left to explain what the men did not have time to explain personally.

Recommendations are as follows:

1. Another year's scouting will have to include larger areas than did that of this year. That means that all of Polk, St. Croix and Pierce Counties should be scouted and such portions of Burnett, Washburn, Barron, and Dunn Counties as is deemed expedient and possible.

2. The pines in the Interstate Park at St. Croix Falls offer a problem. They are probably infected more or less. A large part of the pines in the Park are 15 to 30 feet in height and capable of being climbed and inspected very minutely. It seems that the Park is sufficiently valuable from the esthetic point of view to warrant any reasonable amount of trouble, if necessary.

3. As to control of the blister rust as we have found it thus far in Polk County, one of two things is possible - granting that Ribes eradication over that large area is not practicable: cutting off the pines over the entire dangerous district or cutting a dead line of suitable width around it. No further details will be given here than to present some observations made during the last few weeks of the campaign. The southeastern corner of Polk County cut off by the Northwestern Railroad is poor Ribes country; it is thinly settled, the land is still full of the stumps of the pine cutting of 40 or 50 years ago, covered with more or less scrub stuff - chiefly aspen - little land cleared and bearing very few pines. As one goes over this country where the trapping of fur animals is still profitable and where 15 to 30 coyotes are caught each year, the pines are single for the most part and very scattered. The eastern half of the towns of Clayton, Beaver and Turtle Lake offered very poor Ribes scouting - very few bushes were found in all day searches (two were found in one whole afternoon around Turtle Lake), the woods being almost entirely very thick growth of small aspen or scrub oak. And likewise as the scouting party swung northward through Apple River and north of Balsam Lake (the lake - sometimes called Elkins Lake) several large stretches were noted and mapped as being poor Ribes country.

The idea that arose was that it might be possible to clear off the pines for a sufficiently wide belt in these regions where there are insufficient Ribes to allow the disease to spread outside and thus hem in the infected area; that is, make a belt wide enough so that the disease could not clear it at a single leap nor cross it in a few jumps on what few Ribes might be left in that area. The scattering of pines in a large part of this district and the scarcity of Ribes in places makes such a measure seem feasible. It may turn out that the pines are too thick or the Ribes too extensive in some quarters to make the plan practicable, but this meager information is offered for consideration as possibly being of some value.

4. More efficient educational work should be organized for another year.

Minnesota: At the suggestion of the Director of the Experiment Station the Plant Pathologist took charge of survey and eradication in the St. Croix valley and the Entomologist was responsible for the same work in connection with nurseries,

leads from nurseries, parks, cemeteries, plantations and private plantings over the state, as well as the survey work outside the St. Croix valley. At the time this division of the work was agreed to, the expression "St. Croix valley" was intended to indicate the small restricted area close to the river wherein certain very serious infections were known to occur, and where most extensive work was called for. Later as the area of infection was found to be farther reaching than was at first supposed, the St. Croix district, over which work Dr. W. M. Freeman, Plant Pathologist, had complete charge, was enlarged to include all neighboring counties or parts of counties whose waters drained into the St. Croix. Of necessity, in accordance with the state law, the Plant Pathologist was made a deputy of the State Entomologist in that area.

An average of from eight to eleven men constituted the working force of deputies of the State Entomologist in the field during the summer. The force in the St. Croix district under the Plant Pathologist of the Experiment Station numbered in the early summer eleven men. That number was increased materially at times during the season and fifteen lumberjacks were employed to do the cutting at Dry Creek.

With the exception of two infected leads and the finding of one infected pine seedling in a nursery far south of the infested area, and far south of our pine belt, the blister rust has not been found in Minnesota to date west of the Miss-

issippi. This is by no means to be regarded as a guarantee that it does not exist west of the Mississippi, and a large number of "leads" recently listed with us from the books of a 1916 infested nursery calling for most intensive inspection next season promises the possibility of finding the disease in one or more of the localities to which these "leads" call us. ^{infected} The/leads and single tree above referred to have been destroyed, and the nursery quarantined as to shipments of white pine.

About one hundred forty-three nurseries were inspected by deputies for evidences of blister rust on pine or Ribes. Many of these nurseries were visited twice by the inspectors and some of them three times. The first inspection early in the season covered both pines and currants and gooseberries. The second inspection was made of the currants, because the disease might not be apparent at one time and yet show up from four weeks to two months later. This latter fact explains why a certificate granted in the regular nursery inspection cannot be a guarantee of freedom from blister rust.

Inspection of "leads" from 1916 infected nurseries has constituted a large amount of the season's work. It was, and still is, the policy of State and Federal workers in Minnesota to destroy all trees in leads from infected nurseries whether the disease is apparent or not. Leads, however, which have been planted for several years, six or seven or more, and show no infection, although originally from an infected nursery, should not necessarily be destroyed.

Number of towns visited in the examination of	
nurseries for pine	149
Total pine plantings inspected	284
Number of pines found in plantings (approximately)	100,000
Number of time plantings were inspected:	
242 plantings were inspected once	
38 plantings were inspected twice	
4 plantings were inspected three times.	
Number of plantings destroyed	71
Number of pines destroyed (approximately)	6,500
Number of infections found on pines in leads and	
nurseries	8

Every effort has been made to trace all of the shipments from or through the Illinois nursery apparently responsible for the original infection in Wisconsin, and it was supposed that a complete list had been obtained. We were astounded, therefore, to receive a letter from this firm in September, 1917, stating that they had found in their old records, invoice of a shipment of 30,000 white pine transplants to the Scott-Graff Lumber Company, Duluth, Minnesota, May 14, 1909. We immediately got in touch with the Scott-Graff Company and learned that they had planted 43,120 pines on Sections 26 and 27, W 1/2 of SW 1/4, Township 56, Range 8, Cook County. Fearing that these trees, 30,000 of which came into Minnesota the same year the infected trees were sent to St. Croix Falls, Wisconsin, may have brought disease into our northern woods, deputies were immediately sent to the above locality near Lake Lax to make a thorough inspection of this planting. They found that partly through the agency of fire and rabbits these trees had been reduced to barely 5,000 and the inspection

showed no evidence of rust.

During the season deputies from this office found that a few trees which originally came from Germany still remained in the state planting near Pillager, and these trees were inspected and destroyed by our force after the deciduous trees and shrubs had dropped their leaves, when the pines could be easily found. No evidence of disease was found upon these trees.

As stated, Dr. E. M. Freeman, Plant Pathologist, is responsible for all work this year in the St. Croix region. All credit, therefore, and all responsibility for this part of the work rests with him. Most careful scouting has been done in this territory, the white pine blister rust localities being accurately mapped as well as the distribution of Ribes in the immediate vicinity of all pines. Blank township maps were supplied to guide the scout and to be used also for mapping and blister rust data. Most of the territory was covered on foot, although scouting was facilitated very often by use of bicycles, motorcycles, automobiles, teams, railways, electric car lines, canoes, launches and rowboats, the idea being to cover the ground in the process of scouting in the most efficient manner. Two camps (supplies and equipment purchased on State Funds), worked the territory about their respective camping sites. In addition individual scouts were assigned to work ^{at} a distance from the camps, carrying with them for this work one tent for sleeping purposes, ob-

taining their board from near-by farms or hotels. In a few cases these scouts cooked their own meals.

At Pine Hollow Creek, where blister rust was found in 1916, a camp was established May 1, 1917, with fourteen scouts and a cook. The State Forester's office estimated at this place there were approximately 10,000 board feet of pine besides a goodly amount of sapling stock. This pine was immediately cut and closely inspected. On May 8th the first infection was found and a number were found at various dates after that. All pine here was cut by May 30th. Similar measures were employed at Dry Creek, although, there, lumberjacks were employed to do the cutting and the pine at the latter locality covered about 214 acres, representing about 150,000 board feet. One infected pine was found. Scouting was continued up and down the river.

During the course of the work a most serious infection was found at Afton, south of the scouting operations of 1916. From June 12th to September 15th a crew of from three to eight laborers were working continuously at this point. This infection was so serious and the spread of the disease on Ribes so rapid that a change in method had to be adopted and work was confined to eradication on the outside limits of the infected area in an endeavor to check this spread in directions where other pines were in danger of infection. Summarizing the season's work in the St. Croix Valley: the scouting between May 15th and November 1st resulted in cover-

ing and mapping approximately 2,296 square miles of territory in the St. Croix Valley. This scouting reported 18 new infections of the Blister Rust, 10 of which are single pine infections; 2 quite large infected centers numbering 100 infected trees or more; 2 isolated Ribes infections, and the rest are pine infections of two or three trees. Out of the 10 single tree infections, seven were reported found and cut before fruiting could take place.

The eradication results of the season were very thorough and effective. After eradication in 1916, no more infections were reported in the vicinity of the infected nurseries. The Pine eradication at Dry Creek and Pine Hollow seemed to be very effective in stopping the disease from spreading, since no more has been reported from either area. The Ribes eradication at Afton covered approximately 600 acres, but the infection had obtained such a start before it was discovered that it was only possible to check the spread by the eradication. All single tree infections were cut and burned when found and in seven cases no Ribes infections followed. Only three pine infections are known to be in the state at present which are at all serious; namely, Afton, Rush Lake and Pine City. Where isolated Ribes bushes were found infected, these were pulled and burned by the scouts.

The condition in Minnesota is most critical. Under conditions existing at present, and if the disease is not found

next season in our large timber tracts in the north, it would appear that Minnesota has a fighting chance of keeping this disease restricted to the infested area as found in 1917, and possibly, after a number of years eradicating it for the time being in the state. Manifestly a large amount of scouting will be necessary.

Naturally, this is a forestry problem and calls for investigation and expert work on the part of a forester, for the question of lumbering and forest management is involved. Therefore, as is quite fitting, it has been thought best by authorities concerned, to include in the work for next year, the Head of the Division of Forestry of the Agricultural College, who would, with the Plant Pathologist of the Station and the State Entomologist, work under the State Entomologist's Law, that being the only statute at our disposal for this work at this time.

North Dakota: In 1917, the first work of surveying for the blister rust was carried on by a Federal agent in cooperation with the State Entomologist, Mr. C. B. Waldron. Inspections were made of all white pines which had been shipped into the State, of which there was any record. Five inspections were made in four towns and cities. Fifteen days were spent by one man in the state, on pine inspection and on a survey of the State for the distribution of Ribes. Ribes setosum and R. aureum were found extending along the river clear to the western edge of the State while other species of Ribes

occurred in central and eastern North Dakota. The white pine is not well adapted to the state and for that reason has been little planted.

Of three known shipments of white pine from an infected Minnesota nursery, only one was found where the trees were living. This was at Neche, Pembine County, within a mile of the Canadian line. Only one nursery had any five-needed pines and those were limber pine.

South Dakota: Prior to 1917 all work concerning the blister rust was carried on by the State Entomologist, Mr. Harry C. Severin, who annually inspected the nurseries of the state. Upon communication in 1916 from Professor F. L. Washburn, of Minnesota, regarding a shipment from an infected Minnesota nursery to South Dakota, the State Entomologist destroyed this white pine.

During 1917 a survey of the white pine was made by a Federal agent, F. F. Weinard, in fourteen places in eleven towns. The blister rust was found at only one place, on a shipment of two pines from the Minnesota nursery already mentioned to a farmer in Estelline, Hamlin County. One of the two trees had died prior to 1917. The diseased tree was destroyed by Mr. Weinard. One other shipment of four trees from this Minnesota nursery was destroyed on suspicion. Several other shipments from another infected Minnesota nurs-

ery have been received in South Dakota and these were traced as far as possible.

Twenty-eight days were spent in the survey which included an extensive trip in western South Dakota to secure data on distribution of Ribes. Several species of Ribes are found extending along the rivers to the Wyoming and Montana line.

The work in the state was carried out under a new act approved March 10, 1917, "to prevent the introduction and spread of injurious insects, arachnids, worms and dangerous plant diseases in the State of South Dakota".

Iowa: Although quite an intensive survey was carried on in Iowa in 1916 by the State Entomologist, no blister rust was found in the state.

In 1917 after a more intensive survey by four different Federal agents, (their total time amounting to $6\frac{1}{2}$ months work for one man) in cooperation with the State Entomologist and at least two assistants, but one case of the blister rust was found. This case of rust was on limber pine (Pinus flexilis) shipped from a Minnesota nursery in 1915 to a farmer in Larchwood, Lyon County. Steps are being taken by the State Entomologist to get rid of the other limber pine in the same lot as the diseased tree.

The whole state was covered in the survey; all nurseries being examined for both white pine and Ribes; while all plantings of white pine from single trees to several hundreds that could be gotten track of were examined. Special emphasis was

laid on the tracing of white pine shipments from two nurseries which have in the past six years sent out a lot of diseased trees. Wherever possible, these shipments to Iowa points, to private owners as well as nurseries, have been destroyed, thus preventing the spread of the disease to other lots of white pine either in the same nursery or to neighboring trees.

The total number of inspections made in 1917 was 432, in 139 towns or cities.

Work has been carried on under the pest and disease control law. No quarantine has been established as yet.

Missouri: Although all of the nurseries of the state have been regularly inspected by the State Entomologist's Office, and the plantings of white pine have been inspected by Federal Agents in 1917, no specimens of blister rust have ever been found in the state. In 1917, two Federal inspectors worked in the state for a period equal to 26 days for 1 man. Over 5,600 pines were inspected in 21 places in 9 towns and cities.

Special attention was paid to inspections of pines shipped into the state from nurseries which have at one time or other had the blister rust.

Missouri has placed no quarantine to protect herself from the white pine blister rust. White pine in the state is used only for ornamental purposes in parks, cemeteries and on private premises.

Nebraska: Prior to 1917, no special survey had been made in Nebraska for the blister rust though all nurseries had been regularly inspected by the State Entomologist, Professor Lawrence Bruner, and his assistants, and some of them by a Federal Agent. In 1917 two Federal agents were engaged part of the summer in an intensive survey of the white pine for the rust. Their time amounted to slightly over three months for one man. 132 inspections were made in 21 towns. There are thirteen nurseries in the State handling white pines. No blister rust has ever been found in the State.

The planting of white pines has been limited practically to the southeastern quarter of the State. Ribes extend clear across the State along the River course.

An amendment to the Nebraska Horticultural Inspection Law was passed by the legislature in 1917 giving power to the State Entomologist to establish a quarantine against the introduction of dangerous insect pests or plant diseases when in his opinion it becomes advisable to do so.

Kansas: In 1892, a rust was found in Rooks County, Kansas, at the home of Elam Bartholomew, on Ribes aureum which Arthur identified later as Cronartium ribicola. If this was the blister rust, it has not perpetuated itself there for it has never been found there since that time.

During 1917 a Federal agent in cooperation with the two State Entomologists, Mr. George A. Dean and Mr. S. J. Hunter, made a survey of all known white pine plantings in the State

and all nurseries handling white pine. No blister rust was found, though fifty inspections were made in eighteen towns and cities. One man was employed in the summer and fall on survey work for a period of thirty-three days.

Three nurseries in the State have received in the past six years shipments of white pine from an infected Minnesota nursery. These trees are looked on with suspicion and it is hoped that means can be secured to get rid of the stock.

Detailed Consideration of Demonstration Control Areas.

It is evident that at the present time the most important feature of the blister rust problem is to prove that control is both possible and practicable. The establishment of demonstration control areas in the New England States and New York was carried out this year in accordance with the recommendations of the Committee on the Suppression of the Pine Blister Rust in North America, as made at the Albany Conference, in November, 1916. At the time these areas were being established, Professor E. C. Cheyney, of the Forestry Department, University of Minnesota, was appointed to study the control problem as a whole, and to ascertain the manner in which this work may be made most practical and effective. Professor Cheyney's report is quoted in full, because of the able manner in which he covers all phases of the problem, and especially because of the constructive value of his criticisms and suggestions in the development of future work.

Professor Cheyney's Report on Blister Rust Control:

At the beginning of this year the states and the federal government took up the work with a rather hazy idea of the plan to be followed. Even after the Amherst Conference decided on concentrating the work on an eradication area in each state, the purpose of the work on that area did not seem to be very clearly understood. In almost all of the states too much stress was laid on the necessity of covering a large territory and everything else subordinated to that.

This attitude arose from the idea that the eradication areas were the beginning of a movement to clean all ribes from the states. This brings up the question of the true purpose of the eradication areas.

In order to understand this purpose correctly, it is necessary to call to mind the status of the work in the previous year. Briefly it was as follows. When it was too late in the season to obtain adequate appropriations from the different states, the disease was discovered in various places. It was thought to be in its very inception and that prompt action could wipe out what were supposed to be spot infections before it could spread. To this end an emergency appropriation was obtained from Congress to scout out the extent of the disease while the tag ends of the state forester's and nursery inspector's funds were requisitioned in the different states to eradicate the disease in the spots already discovered. Swift action was considered the key to success.

By the end of the season the scouts had discovered that the infection was generally spread over New England and not confined to spots. This meant that the task of eradication was too large to be completed in haste and prompted the necessity of a comprehensive study to determine the possibilities of eventually rooting out the disease. Obstacles to the discovery of pine infections made the eradication of infected pines impracticable and directed attention to the destruction of Ribes. The following legislative season had made considerable funds available, both federal and state. The problem was to spend these funds in such a way that the necessary data on the costs, methods and possibilities of ribes eradication could be obtained, and at the same time obtain substantial results that would be of permanent value. It seemed that this would be best accomplished by concentrating the work on definite areas which would serve as experimental areas for future study, as a demonstration of preventive measures, and as a trial of methods and costs.

General Criticisms of Demonstration Control Work in 1917:

(1) A criticism which applies pretty generally to the work as a whole is that too little thought was given to the purpose of the work to be done. The decision of the Amherst conference was accepted as read and very little thought given to what the result would or should be. This attitude necessarily led to several errors.

(a) Since no definite purpose was in mind, other than the clearing of as large an area as possible, no provisions are made for making the proper observations or keeping the proper records. Consequently much valuable information, which might have been obtained, was lost.

(b) The idea of making a showing with a large area overshadowed the idea of thoroughness and much ragged work resulted. The ultimate results were lost sight of.

(c) The eradication areas were not selected with as good judgment as they might have been.

(2) The field work was left too much in the hands of foremen without definite enough instructions and with too little supervision. The men responsible for the work were too much in the office, and in many instances had more work than they could attend to. Possibly this could not be avoided, but it is a great weakness and should be avoided in the future.

(3) The organization was often lax. This led to misunderstandings, irresponsibility, and consequently slack work.

(4) Important problems on which all future policies must depend and which can be settled only by systematic experiment were in most cases entirely ignored.

(5) The work was not, in many cases, planned out far enough in advance and there was inevitably much lost motion in consequence.

Review of Work by States:

Connecticut: On the whole, the work in Connecticut was well organized. The work was concentrated on a single eradication area and a responsible head was present to give constant supervision to the crews. The men were all kept in camps close to the work and the camp organization was admirable.

The apparent faults were in the methods used and the smaller details of the work. The crew foreman did not have the age to make for the best efficiency. The crews used were larger than one man can handle properly, especially in a skunk currant area. The foreman worked in the line with his men where his supervision of the crew and the character of his work are both discounted. The crews, worked too rapidly, and more emphasis was given to the area covered than to thoroughness. Adequate records of the ground covered and methods used were not kept and no effective check was made upon the thoroughness of the work.

The eradication area seemed to be regarded as a beginning of a state wide clean-up rather than an experimental area.

Maine: The work in Maine was on a smaller scale than in any of the other states and less time was given to the study of their work. They operated but one crew. Hence they did not have the problems of organization and supervision which existed elsewhere. The foreman was a mature man of wide woods experience, but the personnel of his crew was poor. He worked behind the line and checked up the individuals of his crew. In spite of this, some rather poor work was done. The crews were boarded in hotels both at Kittery Point and Alfred and much time was lost in consequence. The same criticism applies here in regard to lack of plans and records as in Connecticut. The purpose of the eradication area did not seem to be very well understood. Very little information can be obtained from the season's work.

Massachusetts: Less was accomplished in Massachusetts in proportion to the money expended than in any of the other states. The fundamental weakness was in the policy adopted and the lack of organization. The money expended on the work of the town men outside of the eradication areas was virtually wasted. The occasional eradication of an infected cultivated Ribes, while the wild plants in their immediate neighborhood were allowed to harbor the disease unmolested, accomplished practically nothing in the suppression of the disease. The repeated working of the same ground made the little that was accomplished unjustifiably expensive. The only real accomplishment of these men was in the education of the people, and it seems likely that this could have been more effectively done by much less expensive means.

This plan was modified after the conference of State Co-operators, held at Amherst, Massachusetts, on July 17 and 18. The revised plan, as outlined in the renewal of the cooperative agreement between the State and Federal Government, specified that "the State of Massachusetts consents to devote not less than half of the total cooperative blister rust expenditures

to the complete eradication of all currants, gooseberries and other plants of the genus Ribes (cultivated and wild, diseased and non-diseased) from such designated demonstration control areas for the suppression of the white pine blister rust as are mutually approved by the parties to this agreement. Such demonstration control areas shall have a minimum area of five square miles and a minimum width from border to border in any direction of not less than one mile". It was further agreed that in the worst infected towns of the State where wild Ribes are generally present (about 125 towns), inspection by local men should be reduced to not more than one day per week per town; this work was largely to arouse and hold public interest in blister rust control. In the remaining towns (about 225) work was to continue as earlier in the season, the time spent being determined by the degree of infection in the town, the value of the pines there and local interest in control work.

The eradication areas were well selected, but the work done on them was not of the highest order. The worst fault lay in the lack of knowledge of the purpose of the work on the part of the local men in charge. They had neither definite enough instructions nor close enough supervision. The responsible heads were not in close enough touch with the work. Lack of proper inspection led to careless work. Territory seemed to be the aim rather than thoroughness. As would be expected under such loose organization, the quality of the work varied with the character of the local men in charge. Some crews were well organized and doing thorough work, as good as could be found anywhere; others were poorly managed and slighting the job.

The lack of definite plans for the work and of proper records and information on results was very marked. Everywhere the men boarded in towns - with the necessary result of short hours and high cost.

Many of these faults would have been remedied by a little foresight in directing the policy, and a more definite organization.

The town men have possibilities for educational work, but their time has been almost completely wasted under the present policy.

New Hampshire: The work in New Hampshire had many good qualities and some faults.

The faults resulted from too much work in the central office and a consequent lack of planning and supervision of

the field work. The intentions were good, but lack of help in the central office and some confusion caused by the absence of the State Forester weakened the organization. Too much was attempted and the necessity of propitiating political supporters lead to a scattering of the work in the early part of the season. This in turn caused the territorial idea to overshadow the true purpose of the work and resulted in some lost motion.

Later in the season this idea was overcome to a considerable extent. Field studies made it possible to adopt the crew organization to the conditions encountered. Since the ribes encountered were mostly skunk currants, which occur in dense masses, a three-man crew was used. In this way the whole crew could concentrate on clumps of bushes and deploy again without loss of time. With a larger crew some of the crew is necessarily idle at such times. The foreman worked in the line. Even with such a small crew, it is questionable whether this is a sound practice. A study of the territory covered and an accurate record of work and costs should furnish a good basis for deducing some valuable information from the summer's work. The actual results accomplished in the field may not have been any better than in some other places - for some of the foremen were rather young for the job and some undesirable crew men were retained when they should have been fired, but the personnel was on the whole of a rather high order and the purpose of the work was pretty well in mind. Some crews were maintained in camp and others in boarding houses. This made comparison possible, and the advantage lay wholly with the camps.

This summer's work should be good foundation for some excellent work next year.

New York: In New York, as in New Hampshire, the work suffered from a lack of help in the central office. Too much work was undertaken; more than could be properly organized and supervised with the force available. Nothing more could have been asked of the man in charge, but there should have been at least three of him to look after the amount of work attempted.

The value of the work on the two mile barrier is still in doubt. The measure was inaugurated before sufficient scouting had been done to determine its proper location. In some places it was found to be within the infected area, in others it appears to be the western boundary and has apparently been successful in preventing the spread of the disease. But whether it happened to be a true barrier or not there is no reason why it cannot serve the purpose of a demonstration area as well as any other.

As would be expected where work is done under pressure and with insufficient supervision, some of it is good and some poor, as the local men in charge were good or poor.

The destruction of cultivated plants and the consequent remuneration charges were very heavy and would be disastrous in many states, but with the wealth of New York State and the backing of the powerful Conservation Commission, it will probably cause little trouble. A little tact would have saved a great deal of hard feeling.

The same lack of plans and lack of records are present here as elsewhere. Much valuable experience has been gained in this summer's work, and based on this experience an entirely new and definite policy should be worked out for the state before another year.

Much good work has been done in obtaining the cooperation of private owners and the conditions of forest ownership, with large tracts of land in the hands of wealthy owners, should make this a hopeful field of action. This possibility with the strong power of the Commission back of the state work should make a good basis for effective work in the future.

Rhode Island: There were both good and bad features in the Rhode Island work. The area was well chosen and the work well planned. Good records were well kept. The man in charge of the crew was exceptionally capable and the work of the crew seemed thorough. As a source of information the work has been a success.

It was in the administration that the weakness lay. During the first half of the season, the crew was quartered in Providence and carried 25 miles morning and night by auto. There was no excuse for this great waste of time and energy, - board could have been obtained near the work. A camp outfit would have been still more economical. The man in charge lived in Providence throughout the season, going out to the work at seven in the morning and usually returning at noon. He also could have lived near the work and found profitable employment. The result was a lack of economy. The qualifications of the foreman prevented any other serious shortcomings.

Vermont: The policy in Vermont was good and the administration of the work was as thorough as the multitudinous functions of the man in charge permitted it to be. He

was greatly handicapped by having two or three other jobs thrust upon him by the state commissioner. What time he had he used to good advantage.

The starting of the work at Lyndonville was a mistake. Any work in Vermont which involved the eradication of cultivated ribes would be a mistake under the present law. It was abandoned as soon as found impracticable.

The work at South Royalton seemed rather slack, owing to the quality of labor employed and the enforced lack of supervision.

The work at Woodstock was well carried out under a very good local man. The one place where high school labor seemed to be effective.

The main eradication area at Thetford was carried on under very competent management of a good superintendent who obtained thorough work. Careful study was made of the area and good records kept. Vermont should have more valuable information at the end of the season than any of the other states. She recognized her work to be experimental and carried it on on that basis.

The Purpose of Demonstration Control Areas:

Control areas should answer certain questions which can be anticipated. A very thorough discussion of the matter with the state leaders brought out the fact that they would be unable at the end of this season's work to answer any of these questions much more definitely than they could at the July meeting in Amherst. They expect to have two figures only: the extent of the area in which they have conducted eradication work and the cost of that work on the area as a whole. Such figures mean little and are not applicable to other areas without the use of certain converting factors, which they will not have. For example these areas contain many different types of land in which eradication costs very tremendously, and the lump figure is not applicable to a given tract which may contain only 1 or 2 of these types. The costs must be analyzed so that the cost of work in the different types may be segregated and applied to like types in other localities.

Further, slight effort has been made in the state eradication areas to determine the degree of efficiency in the different areas. The cost of handling the eradication work on these same areas in the second season depends largely on the thoroughness of the first year's work. For

example, work which cost \$200.00 per square mile the first year and took out only 75% of the plants may (when the work in future years is considered) be more expensive than \$250.00 work which took out 95%. Till some definite figures are obtained on the thoroughness of the work done the real cost of the past season's work can not be computed.

These converting factors must be obtained if the State and Government are not to be criticised for having spent so much money during this season and yet being unable to answer the following important questions:

- (1) How efficient will they be in stopping the disease?
- (2) How much will it cost on a given tract?
- (3) What per cent of plants will be taken out the first year?
- (4) What will be the conditions the second year?
- (5) What will be the cost the second year?
- (6) The third year?
- (7) What is the best crew organization for this work?
- (8) What are the best methods of work?
- (9) When is the best time to work?

The first question can be answered only theoretically at present. Many years of systematic observation must be carried out.

To determine the cost on a given tract it is necessary to classify all the land in the eradication area on the basis of time required. All New England can be classified into a few easily recognized types which must be represented in the eradication area. If the cost on each type is kept separate results will be obtained that can be applied to similar conditions.

Owing to the human element, the presence of seedlings now invisible and to the growth of sprouts there will be a certain amount of growth the second year. It would be neither just nor safe to give people the impression that absolute eradication could be effected the first year. The work to be done the second, third and maybe fourth and fifth years must be determined and included in all recommendations.

There are various ways of organizing crews and the selection of the right way may save much time and money. The best organization and the best methods of work for each type can be determined only by experiment.

In some brushy types there are strong indications that work can be done much more thoroughly and quickly in the spring when the Ribes sprout before the other plants. The possibility of saving in this way should be tested.

Mapping the Area:

In order to get the most out of the eradication areas the following work should have been done in the spring before the work of eradication was started.

The area should have been carefully mapped, to show rough topography and the following types:

- (1) Pine forest (Over 50% pine)
- (2) Hardwood forest (Less than 50% pine)
- (3) Brush land (Cut over and coming into dense brush)
- (4) Old meadows (abandoned clumps of brush)
- (5) Swamps
- (6) Stone walls (Cultivated fields and used pasture land are practically covered by this type).

The area of each type should have been recorded and the days of labor in each recorded separately.

On this map the work should have been recorded each day as done showing the area covered, the direction the strips were run and the number of plants removed.

It is not too late, even now, to get much valuable information from such a map. The proportion of the different types could be determined and the cost of each calculated as shown farther on. Experience has shown that a second working at right angles to the first always gets results. The record on the map of direction of work would make it possible to plan the second year's work at right angles and gain in efficiency. By knowing the character of all the land to be covered the work of the crews could be much more effectively directed, especially in the seasonal work. Permanent plots for future study could be easily located.

This work applies locally and specifically to each eradication area and should be carried on on every eradication area in every state if results are to be obtained that can be intelligently applied elsewhere.

Centralization of Investigative Work:

Owing to the various conditions in the different states, the uncertainty of state policies, the lack of the proper personnel, and the futility of so much duplication there are certain problems for intensive study which could best be

handled by the federal office independently for the co-operators.

The questions of the relative cost of eradication on the different types - through which the cost on the areas already covered this year can be properly apportioned, - the relative efficiency of different methods of work, and different crew organizations are those which appear the most important and the following working plans are suggested for them.

Working Plans: Select an area of sufficient size and conveniently located that contains all the types in above classification.

Arrange for its use, protection and administration for ten years, either through cooperative agreement or lease.

Employ crew of at least 6 good men and foreman.

Map the area carefully for topography, roads, fence lines and types.

Lay off plots of 10 acres or multiples thereof in each type and mark them permanently.

Each of the following series is to be tried in each type. Series #1. To determine relative costs in different types.

- (a) Crew of 6 men and foreman in line go over in usual way. Record time and number of plants.
Lay off in this 1 acre to serve as permanent plot. Do not touch this plot in future operations but make absolute count of Ribes on it.
- (b) Go over ground again at right angles with exception of acre plot. Record time and number. Lay out another plot in this twice worked area.
- (c) Go over third time. Same record, 1 acre plot.
- (d) Repeat till nothing is obtained.

Series #2. To determine best position for foreman. Repeat series #1, (a)-(b)-(c) with foreman zigzagging back of crew. Leave plots as before and check them.

Series #3. To determine best size of crew.. Repeat series 1 and 2 with three man crews.

Series #4. To determine best method of marking strips.



- (a) Use compass and no marks.
- (b) Use compass and marks.
- (c) Keep crew spaced outside man breaking brush and following back on own line; other end man breaking on return.
- (d) Same as (c) only same man doing all breaking and another man always following him.
- (e) Marking with torn paper.
- (f) Marking with tags and checking.

Series #5. To determine the minimum distance to which Ribes must be eradicated from pine.

In a circle with a radius of 500 feet plant white pine transplants spaced 8 x 8 feet. Stock to be obtained from absolutely safe source. Observe pines carefully and note infection. Plant diseased Ribes at center of pine.

Scout area thoroughly in early spring and from time to time through summer for other Ribes. Stock needed 13 m 2-1 or 1-2 white pine transplants.

Recommend selection of area in some cultivated lands belonging to some state institution or on sand lands of Cape Cod.

Area must be free from Ribes for radius of at least 1000 feet.

Crew Organization.

Owing to the great variation in the type of country covered, the species of ribes found and in the density of underbrush encountered, there are necessarily great differences in the organization of the crews, some of them justifiable; but there are a few general principles which can be laid down with little hesitation.

A study of all of the crews shows definitely that at least 75 per cent of the efficiency of a crew depends on the foreman. Only in rare instances have young men, no older than the members of their crews, been successful leaders, and then only through unusual personality. Nor has the older man of lumberjack type been any more successful in handling college or high school men. It is the older man of experience who makes the most efficient leader when placed over men of his own type.

Under these conditions, it seems that money spent for suitable foremen is well invested, even if seemingly high wages are necessary.

In order to exercise the proper control over his crew, a foreman should be given a certain amount of dignity. The selection of the proper man is the first step toward this.

Separate quarters will go a long ways toward increasing it. It gives him a chance to keep up his records, and the added privacy works toward respect. Slightly different work from the rest of the crew, if not essential, works for dignity. Experience shows that a second working of the ground at right angles to the first gives much better results than a second working in the same direction. This is a strong argument for the foreman to follow his crew, zig-zagging behind them rather than working in the line with them. It practically works the ground in two directions at one going over. Moreover it puts the foreman in the position of an inspector where he can check up the work of the crew. It also keeps the crew continually under his eyes and enables him to give more efficient supervision. Practice varies. In some cases the foreman pulled the bushes skipped by the crew, in others he called back the man responsible for the neglect. The latter seems like the better practice, as it impresses the man with his negligence, and does away with any feeling that the foreman is taking advantage of any one man unfairly. In one instance a forfeit system for the bushes found behind a line proved effective. It seems probable that a bonus system with fines for neglect would work to advantage.

In many instances the crews were found to be working short hours and fooling on the job. It should be the first duty of the foreman to see that his crew works full time and does its work well.

A proper view point and contentment are essential to good work. It is up to the foreman to give the men the proper idea of what they are doing and why. Contentment depends on a square deal and personnel. Practically all cases of insubordination and discontent can be traced either to unfairness on the part of the foreman or the character of one or two members of the crew. The effectiveness of several crews this past season was greatly reduced by the presence of one or two unruly members. Such men should be fired as soon as they are discovered and the foreman should have the unrestricted power to do it. The crew will do more without them.

It should further be the duty of the foreman to keep records showing on the map the area covered each day, the number of men, and the direction in which the strips were run. Further notes on the character of the country would be a great help.

Future Policy.

As stated previously, there is considerable doubt as to how far the state should go in actually eradicating Ribes itself. The more common practice in such cases is for the state to carry the work only through the demonstration stage. That is, it shows the private individual that he may protect his interests, carries on the experiments needed to obtain the necessary information, and backs up the work of the individual with laws which protect him from negligent neighbors. Yet in a number of cases where the danger has been very grave and very widespread, the state has attempted to carry the whole work on its own responsibility.

There are three possibilities in the fight with the pine blister rust. (1) For the state to undertake the eradication of the disease in cooperation with private parties. (2) For the state to depute the federal government to carry out the work. (3) To drop all except the experimental work and leave all the eradication work and control work to the private owner.

Something can be said both for and against each of these policies:-

1. The fact that the state is most vitally concerned in the control of the disease is the strongest argument for state control. Where the spread of the disease is general, the interests involved large and diverse, and the number of people affected a large proportion of the population, the problem is too large and the results too far reaching to be left to the chance work of the individual. Further the state alone possesses the power and authority to carry out the necessary provisions of eradication. It is properly organized to cooperate with the counties, towns and individuals. It is in close touch with the people, and the interest is direct.

However, many of these same factors in state organization which may be a strong influence for good work, may be, and often are, the causes of very poor work. The close touch with the people leads to the introduction of politics into the organization and the result is fatal. In some states it seems impossible to carry out anything, no matter how technical it may be, without such political interference. In almost every state such interference is attempted and is more or less of a drawback.

Certain it is that if this work is to be done by the state it should be under the direction of a commission sufficiently disinterested or too powerful to be swayed by local influences.

2. The federal government has not the authority to carry on this campaign unless it is deputized by the state, as has been done in some of the moth control work. The extent of the disease, involving several states and being more or less of a national menace, is sufficient excuse for considering it as a national problem. The idea has many advantages. There would be no more accusations from one state that her neighbors were neglecting their duties and imperiling her safety. The seat of administration would be sufficiently disinterested and far enough removed to be above the influence of local politics and more important work would be assured. Moreover, the respect of the people for the federal government is far greater than for the state and there would be less attempt to evade or obstruct the law. The money would not come from local taxation and hence there would not be the incentive to local interference.

The only drawbacks to this system would probably be the unwillingness of the federal government to take over the work, and the unwillingness of the state politicians- the same men who would vitiate the state management - to let them have it.

3. Individual control extending over any considerable portion of the state is out of the question without official backing and support from the state. Only the wealthy owner of large tracts of land could accomplish anything, and the success of this effort would depend largely on his ability to beg or buy the cooperation of his neighbors. The owners of small tracts would be almost helpless because their security would depend on the cooperation of such a large number of neighbors. In almost every community there would be some individuals who would refuse to do anything and so hold up the work in the neighborhood. The authority of the state must be available to force these slackers for the good of the state. Every effort should be made to encourage individual work. Much can be accomplished by such cooperation, but without state aid it is nearly hopeless.

It is possible, in fact it seems advisable, that this policy should be adopted in three of the New England States. Rhode Island, Connecticut and Vermont have such a small area of pine of such comparatively small value that it hardly justifies the state in undertaking the work* What little pine there is is in the

* Since this was written, a fairly accurate survey and estimate of pine in Rhode Island, by towns, proves that there is at least 50,000,000 board feet of merchantable white pine in the state, worth \$500,000. All of the lumbermen who were consulted, agreed that the young growth at present represents a value in excess of the merchantable pine. The only fair basis is to secure definite estimates on the value of pine stands in definite areas, and the approximate cost of protection.

hands of so few owners that the rest of the people can hardly be fairly asked to protect them. If the state is to do any work, it would more profitably direct its efforts to the planting of species other than white pine than to attempt to protect the white pine. The results would be much more profitable to the state. The white pine plantations are about the only thing that it would pay to protect. There the growth is sufficiently concentrated.

Future Work.

In Maine, New Hampshire, Massachusetts, and New York, the white pine is certainly a stake worth playing for. On large areas covering the holdings of thousands of owners the white pine is the most valuable crop. In many places it is the only crop and could not readily be replaced by another of anything like equal value. Here the destruction of the white pine would be not only a personal loss, but also a public loss and consequently of statewide concern. There should be no question here as to whether the state should act, what it should do is the only question.

There seems to be but little doubt that the blister rust is strongly entrenched throughout most of these regions beyond any hope of completely eradicating it. It is in New England to stay and must in the future be constantly considered as one of the conditions against which the white pine must contend. It seems useless to look forward to the time when it will be stamped out.

This does not, however, mean that the growing of white pine must necessarily stop everywhere. The indications are that the disease can be controlled locally. If we are to judge by the present extent and distribution of heavy pine infection, the spread of the disease is exceedingly slow. To be sure the results may be cumulative and it may spread more rapidly as time goes on, but certainly unless there is a radical change in its development, there will yet be a number of years before the destruction of the white pine is complete, or even of commercially disastrous proportions.

In spite of the instances cited in which the spores from ribes are supposed to have travelled for several miles, the distance at which they are able to cause serious infection seems to be short. This is a question which should be determined as soon as possible - for the efficiency of nearly all control measures depend directly upon it.

Certainly the progress of the disease is so slow that very little of the pine now within ten years of merchantable size is in danger of being destroyed before it can be utilized. Hence it is useless to endeavor to protect it at present except where

it has other than merchantable value.

If these two points are true, local control is entirely possible, and, wherever the timber is of sufficient value entirely feasible, through the eradication of ribes.

Before any further eradication work is undertaken, the conditions should be analyzed and the following points determined:

- (1) To what distance may the telia spores be reasonably expected to infect pines in dangerous quantities?
- (2) What age classes of pine will it pay best to protect and which need immediate protection the most.
- (3) What value must the pine have to justify protection?
- (4) How small an area can be used as a unit with reasonable hope of success.
- (5) Where is the currant and gooseberry industry of more value than the white pine?

From the results of this analysis, the areas can be readily selected on which the first work of eradication for control can be most profitably done. But it would be extremely hazardous to start any eradication work for control purposes before these questions have been satisfactorily answered. Their solution will require at least another year, possibly - indeed probably - longer. In the meanwhile the work of the state should be confined to the reworking of the ground already covered and publicity work to educate the people to the possibilities of the disease, the possibilities in planting species other than white pine, and the advisability of mixed plantations. Too intensive work cannot be done along these two lines. The publicity work should be taken up at once and pushed hard. The winter is a good time to do it. Many of the men who have proved their value as field men could be utilized in this way through the winter and thus held over for the next field season.

Detailed Data on Ribes Eradication in 1917.

In general, it was not possible this year to institute a comprehensive system for collecting complete information on comparative costs and methods of eradicating Ribes. The following tabulation summarizes this data so far as available for the principal demonstration control areas:-

State	Location of Control Area	Ribes Eradication					
		Total Acres Covered	Total No.Cult. bushes removed	No.Cult. bushes paid for	Av.Cost Compen- sation per bush	Av.No. Wild Ribes per Acre	Av.Total Cost Ribes erad.per acre
Maine	:Kittery Point:	1900	530	0	0	7	\$1.50
	:Alfred	3200	1400	0	0	11	.39
N. Hamp.	: North Conway:	1152				27	0.89
	: Stratham	11520	0	0	0	9	0.38
	: Keene	2560	1250	461	0.176	117	0.327
Vermont	:North Thetford	4150	57	57	0.388	6	0.57
	:Topsfield*						
Mass.	:Lenox*	5120		0	0	3.5	0.24
	:Warwick	22300	1150	0	0	.6	.10
	:Athol	10000	4284	0	0		.28
	:Dana	11189	1018	0	0	1.3	.9
	:Barre	3680	5050	0	0	2.8	.46
	:Petersham	4000	1420	0	0	7.5	.42
	:Pembroke, etc.						
Rhode I.	:Summit-Greene:	8236	951			0.5	0.34
	:Norfolk	4000		0	0	Many	.85
New York	:Lewis	11900				5-300	1.12
	:Clinton Co.	4076				1.5	0.23
	:Washington Co:	2120					0.25

111,103

*Second time over area; first time in 1916.

On three control areas work was done in sufficient detail to secure cost data by types of wild Ribes growth.

Vermont Control Area: The Area is located in the towns of Thetford and Fairlee, Orange County, Vt. It is bounded on the east by the Connecticut River and on the west by Fairlee Lake. The tract comprises 4450 acres or nearly 7 square miles.

Extending westward from the valley of the Connecticut River, which flows southward along the eastern border of the Area through a plain which varies on its west bank from 50' to 1/2 mile in width the country begins to rise abruptly from an elevation of 400' above sea level, on the river bank, to an elevation of 900'. From this general elevation the slopes are less steep to the round topped hills forming the Potato Hill Ridge which extends almost across the entire tract in a NE - SW direction. The topography on the whole is rough. High Peak in the south-western portion of the area is the highest hill with an elevation of over 1600'.

Currants are not grown here on a commercial basis. A few of the farmers own enough bushes to supply their household needs.

Agriculture and lumbering are the chief industries.

Wild Ribes (prickly gooseberry, smooth gooseberry and skunk currant, in order of abundance) were found to occur over the area, varying from 2 - 3 plants per acre to several hundred. They were found most abundant on the slopes of the main ridge and the pasture sloping to the Ely Road. The abun-

dance of Ribes on a particular site is not so much due to the topography as to the particular soil and moisture conditions and ground cover. It is reasonable to suppose that an area with a ground cover composed of raspberry and blackberry bushes or clumps of brush in which are growing such plants as clematis, grape, or woodbine and furnishing food for birds is the place where the Ribes will be abundant. A type furnishing a good harbor for birds will quite likely be prolific with Ribes. On this area the topography appeared to be a minor factor in the general distribution of the Ribes. However, the topography does influence the presence of species. Skunk currants were found confined to the swamp and cliff areas.

The severest Ribes infection was found along the eastern slopes just down from the top of the ridge, along the roadsides and fence rows. One severely infected bush was found, along a wire fence, over 10' high and with a spread of 6-7 feet.

The direction in which topography deflects air currents will influence the distribution of the disease - a slope protected from a direct breeze carrying fungous spores will be less liable to infection than a slope directly exposed. A valley which forms a sort of a channel for the wind to sweep up is in hazard of becoming infected.

A topographic map of the control area was made and on it was plotted the types of vegetative growth. No type area of less than an acre was considered. The map also shows areas where Ribes are abundant, skunk currant areas; severe Ribes infections and suspected pine infections are located. The

following is a description of the types recognized:

Immature Pine - reproduction areas and stands of pine of too small a size to be classed as merchantable.. 5" D.B.H. was chosen as the upper diameter limit of immature pine to assist in classifying types I a and I b in the field.

Merchantable Pine - Included under this type are stands of pine over 5" D.B.H. About 20% of the pine area mapped is composed of over 50% Hemlock. The forest floor of the pine types I a varies from the pure pine needle cover to one which is grassy and bearing more or less shrub and grass growth, depending on the openness of the stand.

Hardwoods - Although this type is composed of over 50% hardwood species - there is mixed with it varying amounts of pine and Hemlock. Only a comparatively small percent of this type contains enough pine sufficiently large to be considered of merchantable character, and this is indicated on the map.

The forest floor varies considerably in character from the leaf litter cover with little undergrowth to the rather bushy type of undergrowth composed of grasses, ferns, raspberries, spirea, viburnum, cornus, alder, willow, hazlenut and young hardwood reproduction.

Brush - Included in this type are: (1) the cut over areas with slash covered ground. (2) The pasture and abandoned lands that have come in to a dense growth of bushes and briers with an occasional conifer or hardwood.

Pasture - Pasture and agricultural land comprises 51.7 per cent of the total area. Grazing land that is of the open pasture type and land with clumps of hardwood or pine reproduction are included under this head. Some difficulty was experienced by the uncertainty of the crew bosses in recognizing this type for much of the hardwood and pine types as well as the brush was utilized for grazing purposes. Portions of this pasture land are covered with a heavy growth of thistles and raspberry briars with occasional patches of slash which made the work of eradicating disagreeable at times.

Swamp - This type comprises but little more than 1/2 of 1 per cent of the total area and is practically negligible in the discussion of the whole tract. The ground cover here is composed of bushes, ferns, ^{and} old swamp hardwoods with an occasional pine or spruce.

Labor was scarce and the price high. On the whole the crews worked together well and the crew bosses were onto their jobs and attempted to systematize their work so as to do effectual eradication. The work was well done as far as could be determined by a general inspection. The plants remaining were small and obscured by ferns or grass. After the first inspection 90 per cent of eradication appeared to have been accomplished but this figure is probably too high for on running a check plot on a pine area which was considered to have been well done the per cent actually found was 75 percent; on a hardwood plot 70 per cent, and on a pasture plot 100 per cent. 75-80 per cent would represent the actual figure more closely.

The factors influencing the cost of eradication may be listed as follows:

1. Labor
2. Ground Cover
3. Topography
4. Visibility
5. Number of bushes

In much of the work one factor counterbalances another to offset what might prove to be a disadvantage, for instance a steep side hill pasture may be free from brush or fern growth, thus greatly facilitating the work. On the other hand a level area may be so bushy and brambly that eradication is difficult.

The personal factor is the greatest influence in raising or lowering the cost and upon it rests the efficiency of the work.. It does not take long to consume many working hours by repeated short rests taken by an entire crew. Good supervision is essential.

As a general rule the men preferred to work up and down the slope unless it was too rugged. The eastern slope of the area was run with the contour. A 10 foot spacing between the men was most commonly used to best satisfaction, of course this spacing varied according to the demands of the type. On this question the crew bosses were to use their judgment. The bosses also preferred to work along with the crew rather than inspect after them. This places a little more responsibility on each man and he does not have the feeling that if he misses a bush the other fellow will get it. With old crews this method will prove satisfactory, but with young crews they must be followed after. The crews followed their own line, the outside man blaz-

ing the line and then running back on it.

An attempt was made to correlate cost, area and size of crew for each type but too few figures were obtained to make this satisfactory. If accurate data could be secured it may be possible to graphically represent the relationship between these factors and to secure information which would aid in predicting the cost of eradicating a given type and a given acreage.

This summer's experience shows that the work needs very careful supervision to see that the records are strictly and accurately kept. In some cases the number of Ribes pulled was not actually recorded nor the infection data. Crew bosses don't see the sense of it, yet these are important factors in learning of the distribution and severity of the disease. If faithfully kept these records would afford the foreman an opportunity to check up the crew work and clear up any uncertainties regarding the types. They would also supply the general data needed.

The mature pine standing on the 341 acres of this type, as mapped, is worth approximately \$42,000. The immature pine about \$3,000. With pine prices rising very rapidly these figures will be increased before another year.

Plots H. I. J. & K. were selected because they form a compact block of timberland representative of the woodlot the average farmer owns, the old pine lot, the cut over land used for grazing and the young pine. The plots are readily accessible for demonstration purposes being located adjacent to the Vermont Demonstration Area. The data sheet gives the figures in detail.

Plot H cost more for mature pine of its character than it

should for the crew (5 men) knew the area to be a permanent plot and in their effort to eradicate well took too long a time to perform the work. The results were not above the average. Time was also lost by their eagerness to identify infection. Judging from costs of similar areas the cost on this plot should not have exceeded 50 cents per acre. The cost per M. B. F. standing timber was 3-1/3¢. The stand is old enough to market and the eradication of this plot for protection of the particular pine would not be called for or warranted. The hazard lies in plot K, and to protect it the old pine would have to be eradicated.

Plot J, is a mature pine stand of less value than H, more scattered and with a grassier floor.

Plot I. Between these two pine plots is pasture land with scattered pine and Hemlock.

Plot K. Immature Pine. This plot has good potential value, if protected from fire and ravage of the Rust. A conservative estimate places its value at \$60.00 per acre. This figure was derived by figuring on its future possibility. It is a beautiful stand of natural reproduction, being 99.9 per cent pure and gradually extending its area eastward and moving out the thistles and briars which thrive in the pasture. The stocking in some clumps is very dense.

The plot as mapped and eradicated includes 25-1/2 acres. Assuming that it is desirable to protect it for a surrounding distance of 1000' the following amount of eradication work would be needed.



Immature Pine	8.8 acres	@	77¢	per acre equals	\$6.77
Slash	44.3	"	@	80¢ " " "	34.40
Pine-mature (H)	18.3	"	@	73¢ " " "	12.00
Young Pine like K	13.3	"	@	39¢ " " "	7.13
Pasture	30.	"	@	23¢ " " "	6.90
Hardwoods	10.4	"	@	72¢ " " "	7.48
Pasture	22.	"	@	23¢ " " "	5.06
Fence	3.2	"	@	2.62	<u>8.38</u>

Total cost \$88.12

Assuming that the present 15 year old stand will at 40 years of age cut 20 M per acre at value of \$15.00 per M on the stump, and that it would need to be protected 8 times during that period, i.e., for next three years, and 3 year intervals until 30 years old:-

25 acres - 20 M. per acre @ \$15.00 per M. equals \$7,500.00, value of pine at 40 years of age. Total volume 500 M. The cost of the 8 protective eradications would be, supposing it to stay at \$88.00 per year, \$704.00. This amounts to a tax of \$1.40 per M. for protection in the area and 1000' about it.

To eradicate for 500' about the plot the following work would be required:

Slash	16.1 acre	@	80¢	per acre equals	\$12.88
Young pine (as K)	15.3		39	" " "	5.96
Immature Hdws	7.5		72	" " "	5.40
Pasture	7.3		23	" " "	1.68
Mature pine (as M)	14.2		73	" " "	10.36
Fence	1.2 m.		\$2.62	per mile	<u>3.14</u>
					\$39.42

Plot K may have a little more agricultural land about it than many woodlots, but it serves to illustrate that land can be eradicated for the protection of the pine at a reasonable figure.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Whether the farmer should do the work himself would depend on his general interest and how much he appreciated the situation. Some reasons why the farmer should do his own eradication work are:

1. Cost less than state work.

- (a) Farmer pays an average of \$40.00 per month and board, amounting to \$52.00 per month. State would pay \$60.00
- (b) The farmer employing several men usually has two or more men whose wages are much less than \$52.00 per month.
- (c) The farmer could do the work at such times when the general farm work was lightest, or by working for a few hours or days at a time. No supervision cost.

2. Personal interest of the farmer to protect his own holdings is an incentive to good work.

3. Can train farm hands to readily identify the wild Ribes and in a short time have an efficient crew.

Some reasons why the state should do the eradication work for the farmer are:

- 1. State men are practiced Ribes pullers; an efficient crew will do the farmer's work well and at reasonable price.
- 2. Large areas can be more effectively done by a crew of 5 men who are accustomed to follow their lines and have their work systematized than by the farmer's small crew.

3. There is uncertainty about the farmer getting the work done. Spare time is any old time with many, and results in neglect and unfulfilled good intentions.

4. The problem is one of state-wide interest and reaches beyond the individual door yard.

In many communities it might be possible to form a community association so that the farmers could club together to do the work by furnishing their own crews to work under the supervision of a state expert or even under the supervision of one of the farmers, if he knew the Ribes, and was able to systematize the crew work.. They might club together and pay the cost of eradicating by a state crew. In the final analysis it seems that since it is more than a local problem, and each individual is a member of the state community, that the state, as such, could do the work to the best satisfaction and good of all.

Summary. The first object of the work "to secure information on the control of the White Pine Blister Rust" was accomplished as far as was possible this season. Ribes on 4150 acres were eradicated, including agricultural land, between August 1 and October 6. On this tract cost data, number of Ribes pulled, and degree of infection were kept, but not as accurately as was anticipated. Considering the area as a unit the work was well done. A close inspection and careful eradication begun early next spring will reveal the actual character of the work done.

The second object, that of furnishing a practical demonstration area in Vermont has been carried out. The entire tract may be considered as one large demonstration. Within it are smaller

plots, permanently staked out, marked, and described in these notes with the eradication data. These will serve as small demonstration units to show what might be done by the farmer or small woodlot owner.

Eradication work conducted after the first September frosts went very well for the frost killed many of the ferns and made the Ribes a little more evident. In the open the leaves fall 2 to 3 weeks earlier than in protected areas where they were found persisting on October 28.

Recommendations

1. Careful inspection of Pine in 1918.
2. Eradication started as early in the spring as possible.
3. Very careful notes kept on the degree and stage of infection.
4. More exact records kept by the crew bosses. In connection with this, a clerk who devoted his entire time to the daily record of the crews and kept accurate time and wage sheets for each man would be a valuable asset. A crew foreman could do it, if the bosses kept clear records.
5. Try running the crews according to plotted areas marked out by compass lines.

Summary of Data, Vermont Demonstration Control Area.

Types	Area		Costs by Type				No. one	No.
	Acres	Total for	Cost per acre			man	Ribes	
			Type	Max.	Min.			Av
Immature Pine	: 63	: \$48.34	: .81½	: .68	: .77	: 129½	: 124	
Mature Pine	: 341	: 202.44	: 1.61	: .34	: .59	: 667¼	: 2530	
Hardwoods	: 1014	: 743.51	:	: .19	: .73	: 2087½	: 6248	
Brush	: 377	: 285.79	: 2.16	: .40	: .76	: 776½	: 4184	
Pasture	: 1049	: 248.42	: .68	: .08	: .23	: 660-5/6	: 2070	
Swamp	: 26	: 35.11	: 4.44	: .84	: 1.35	: 58½	: 1715	
Fence Rows	: 28 5/8	: 78.34	: 8.56	: .84	: 2.62	: 203¼	: 2157	
	: mi.	:	:	:	: per mi	:	:	
Total of which	:	:	:	:	:	:	:	
type records	: 2870	: 1641.95	:	:	: .57	: 4583 1/3	: 19048	
were kept.No.	:	:	:	:	:	:	:	
type record	:	:	:	:	:	:	:	
kept.	: 183	: 280.22	:	:	:	: 733	:	
Uneradicated	: 300	:	:	:	:	:	:	
Agricultural	: 1097	:	:	:	:	:	:	
Grand Total	: 4450 A	: 1922.17	:	:	: .43	: 5316 1/3	: 19048	
Travel-lost	:	:	:	:	:	:	:	
time and rainy	:	:	:	:	:	:	:	
days	:	: 621.14	:	:	:	:	:	
Total, Exclu-	:	:	:	:	:	:	:	
sive of super-	:	: 2543.31	:	:	: .57	:	:	
vision	:	:	:	:	:	:	:	

Data to Accompany the Topographic and
Forest Type Map of Plots H. I. J. K. at So. Fairlee, Vermont

Name of plot	H	I	J	K
Type of plot	Mer.pine : 30-40 yrs	Brush : Pasture.	Mer. pine : 30-40 yrs.	Young pine : 15 yr.
Area of plot	: 16.3 A	: 11 A	: 5.9 A	: 25.5 A
No. of Ribes	: 319	: 54	: 128	: 3
Species of Ribes	: Prickly gby.	: Prickly gby.	: Prickly gby.	: Prickly gby.
Average No.Plants per acre	: 20	: 5	: 21	:
% of plants infected	: 13%	: 29%	: 28	: 100%
No. of man hours	: 40	: 20	: 11 $\frac{1}{2}$: 33 $\frac{3}{4}$
Size of crew	: 5	: 5	: 5	: 5
Total Cost	: \$12.00	: \$6.00	: \$3.37	: \$10.12
Cost per acre	: .73	: .54	: .57	: .39 $\frac{1}{2}$
Value of Pine	: 4300.00	: 25.00	: 800.00	: \$60.per ac. est.
Cost per M.BF to Erad.	: 3 $\frac{1}{2}$ ¢	:	: 4 1/3¢	:
% Eradication Accom- plished.	: 54%	: 63%	: 58%	: 100%

SUMMARY OF PLOT DATA - VERMONT DEMONSTRATION AREA

Plot:	Type	Area	No. : Ribes	Man : Hours	Total : Cost	Cost : Per	Value : of	
						Acre	Pine	
D	Mature Pine	4.7	19	13½	\$3.60	.76	\$400.	Floor covered with H'dw'd pine reproduction and bushes
E	"	3.5	5	4½	1.20	.34	350.	Floor clean.
H	"	16.3	319	40	12.02	.74	4300.	About ¼ area brush and brier floor
J	"	5.9	128	11½	3.37	.57	800.	About 1/3 of area covered with grass and ferns.
L	"	13.	135	35	7.54	.58	1700.	Floor generally clean. Light grass and ferns in patches. Trees holding limbs well down bole.
K	Imma- ture Pine	25.5	3	33¾	10.12	.39½	\$60. per acre	Pure pine reproduction in dense clumps.
C	Hard- woods	18.5	29	60	16.80	.90	Negli- gible	Steep side hill. Rocky.
G	"	9.75	251	17¾	7.09	.72	"	About 1/5 acre-brush and slash. Remainder pure H'dw'-ds; light floor cover.
	Brush	12.5	108	30	9.00	.72	"	Ground covered with slash Young Hemlock overgrowth.
F	"	16.	33	30¾	12.40	.77½	"	Moderately thick brush-Wil- low, Poplar, Alder, Birch, Scat- tered Wh. Pine.
A	Pasture	19.3	15	7½	2.60	.13½	"	Pasture. Negligible tree growth. Part of plot heavy thistle cover.
I	"	11.	54	20	6.00	.54	\$25	Grass cover-ferns and Rubus species. Scattered Pine and Hemlock

New Hampshire Control Area at North Conway: This is a rectangular area of about 4 square miles, located in the northwest corner of the town of Conway, New Hampshire. It occupies the valley and lower slopes on the east side of the Saco River.

With the exception of intervale land immediately adjacent to the Saco River, the soil is generally better suited to forest production, particularly to white and red pine. Most of the old

growth has been cut, but pine still persists, and the present stand is composed principally of white pine which shows evidences of rapid growth. In many places this second growth is mixed with Norway pine. But one large stand of virgin white pine remains, to-wit: the Cathedral Woods at Intervale Village. This tract has an approximate area of 170 acres and is said to be assessed for \$70,000. In the entire control area, the pine value is estimated to be in excess of \$50,000 per square mile.

In view of the wide distribution of the pine stage^{of the disease}/in the northern portions of Conway, it was deemed advisable to establish a demonstration control area throughout the entire town, and the work of removing the wild ribes was commenced in that section where the largest amount of infection on both pine and currant had been found.

At the request of Mr. A. B. Hastings, Acting State Forester, Dr. H. H. York, on August 1st, assumed charge of the work in North Conway. The crews were immediately re-organized, in the hope that by so doing better discipline could be maintained and more efficient work secured. Squads of different sizes were also tried out in an effort to ascertain what was the best possible organization of these units.

There seems to be a wide diversity of opinion as to the most practical size of such units. It has been found that as a rule, a small unit will be less unwieldy and will work together much more systematically than a larger crew. This is particularly true where the under-growth is thick and the Ribes many. In open land a larger unit would naturally cover more

ground in a given time than the smaller one. Also, the efficiency of the crew is less liable to be impaired through distraction if it is a small one. However, the question of the size of eradication crews is a matter which should be governed by local conditions, the personality of the men, etc., and is bound to vary in different localities and States.

In the North Conway area, owing to the dense growth, the men as a rule worked six feet apart and the end or out-side man (usually the squad-leader) carried a compass and was responsible for keeping the line straight and for marking the boundary of his strip so that on the return trip same could be followed without difficulty by the inside scout. It was found that keeping one man continuously marking the line proved to make more efficient work than if the marker was changed around from time to time.

The squad-leader was also instructed to keep a record of the number of Ribes pulled on the different plots in which he and his crew worked; the time required to cover each; the time of the individual members of his crew, and any other data regarding field conditions. It is evident from the field data secured during the past season by such methods that there is room for much improvement in recording and turning in such records.

In order that a working basis be established for computing eradication cost according to the various types, Dr. York undertook the mapping of an area in the vicinity of North Conway and Intervale of approximately four square miles. The following types were used: Pine-land; Pure Hardwoods; Mixed pine and Hard-

woods; Brush-land and swamp.

In this area complete data was secured on 1028.08 acres, although the total acreage in which Ribes were removed was much greater. There are several areas for which the eradication costs are lacking. This was due to the sudden enlistment of one of the squad-leaders who failed to turn in all his data before leaving. Just such a case as this shows the necessity of having all such data turned in daily.

In computing the cost of eradication, the salaries of the men, cost of subsistence, transportation and supervision were included. The work was thoroughly done on all the tracts. The value of the white pine on the entire control area is estimated at \$206,000. The cost data is as follows:

Cost Data by Types, North Conway Control Area.							
Type	Total area in acres	No. Ribes	Predom- inating species	Total man Hours	Total Cost	Average cost per acre	Value of Pines
Pine land (17 tracts)	490.17	1,057	Skunk	886	\$377.44	.77¢	\$117,985.00
Pine & Hardwood (3 tracts)	36.60	307	Skunk	123	49.35	1.41	1,300.00
Hardwood (3 tracts)	63.00	None	None	42	40.82	.65	650.00
Brush (7 tracts)	129.71	4241	Skunk	525	216.29	1.667	2,700.00
Swamp (2 tracts)	7.60	16,050	Skunk	169	72.84	9.105	185.00
Mixed type	301.00	6,170	Skunk	421	166.06	.55	67,000.00
Totals	1028.08	27,825	were Skunk	2,166	922.80	.897	189,820.00

Ratio of cost of eradication to value of pine = .486%

As will be seen in the preceding tabulation, the average cost per acre for all types on 1,028.08 acres was \$0.897 cents. This figure may seem somewhat high, but it must be remembered that the work was of an entirely new nature and that much experimental work was carried on in an effort to arrive at the best method of eradication. However, it is believed that another season the cost per acre can be lowered considerably by more efficient organization through more closer supervision, improved field methods, more economical handling of transportation and maintenance of camp crews.

The total area in Conway on which eradication measures were carried out was 8,320 acres.

The following is a record of the total number of cultivated ribes which were removed in the North Conway and Intervale area and the amount of compensation paid.

No. cultivated ribes.....	1406
No. cultivated ribes diseased.....	311
" " " paid for.....	666
" " " destroyed free.....	429
Total " " removed.....	1406
" compensation paid.....	\$306.70
Average cost per bush.....	.462¢

Eradication measures may be divided into two classes; first, the removal of all currant and gooseberry bushes on wild lands, and secondly, the disposal of cultivated varieties. In the case of the first, the same method is applicable at all times, but the destruction of cultivated bushes presents a problem which must be solved in many ways and seldom will the same method apply to more than one case. In order that the work

in any control area will not suffer - (for nothing should be done that will in any way arouse an antagonistic spirit in the residents of the locality) patience, care and diplomacy is necessary in arranging for the removal of all cultivated currant and gooseberry bushes. It has been found by experience that such work cannot be delegated to any of the crew, not even the foremen or squad-leaders. It should be handled by an older man.

It is possible, however, that through a carefully worded and conducted publicity campaign, an appeal might be made to the residents of control areas whereby they could be induced to remove these bushes themselves or at least allow the State to do so without compensation. Perhaps if a feature through the medium of the local press be made of the matter, whereby the names of all persons who voluntarily remove their ribes will be published, it will be possible to secure such eradication without any compensation being paid. There are many persons who will contribute to any cause if a certain amount of notoriety is attached to their gift. It is the hope that some such scheme can be worked up this winter whereby such voluntary cooperation can be secured in all control areas another season.

Rhode Island Control Area: This is a tract of 6,685 acres lying between the villages of Summit and Greene. Elevation varies from 400 to 600 feet. About 15% of the control area is cleared land, the remainder covered with woods and brush, with several small streams flowing through it. The area contains

about 4,000,000 ft. B. M., of merchantable pine valued at \$40,000; about 300 acres of immature pine 6" D.B.H. valued at \$30,000; and 1300 acres young pine under 10 ft, valued at \$65,000 or a total pine value of \$135,000.

A type map of the control area was made with detailed data on infections, location of wild and cultivated Ribes, direction types were scouted, etc. Detailed cost data were recorded for about half of the area. The crews used a compass, men working abreast, five to 10 ft. apart depending on the character of the terrain. The size of the crews varied from 4 to 8 men. Approximately 80 per cent of the wild Ribes were found adjacent to swampy areas, 10 per cent along stone walls, fences and near old houses and 10 per cent were scattered throughout the area. The cost for each wild and cultivated Ribes bush removed was 71 cents, since they averaged less than one plant to every two acres covered. Swampy areas can be eradicated to advantage in the fall because they are comparatively dry at that time, and low growing vegetation, excepting Ribes and a few other plants, has been killed by frost and is without leaves.

Data on trial plots of different types:

Plot:	Type	Area, Acres	Time Minutes	Size crews	Wages per day	Total cost	Average cost per acre
	:Over 50%	:	:	:	:	:	:
1	: pine	: 16	: 173	: 5	: \$3.00	: \$1.034	: \$0.344
2	:Hardwood	: 12	: 119	: 8 and 5	: 3.00	: 1.541	: 0.385
3	:Brush	: 34	: 349	: 8 and 5	: 3.00	: 2.532	: 0.506
4	:Old Mea-	:	:	:	:	:	:
	: dow	: 4	: 20	: 8	: 3.00	: 1.00	: 0.25
5	:Swamp	: 10	: 125	: 6 and 5	: 3.00	: 1.739	: 0.434
6	:Stonewall:	:	:	:	:	:	:
	:farm land:	: 9	: 39	: 8 and 6	: 3.00	: .367	: 0.183

Total No.	Wild gooseberries destroyed	2410
"	" currants	1028
"	" cultivated Ribes	951
	Total	<u>4389</u>

No. cultivated Ribes infections in control areas	6
" wild	2

No. acres of pine eradicated	2980
Total area eradicated (acres)	8236
Average cost of eradication per acre	\$0.34

Cost of eradication per acre by types (average of all data on regular field work).

Dense Pine (50% or over).....	0.50
Hardwoods.....	0.34
Brush.....	0.66
Old Meadow.....	0.15
Stone Walls.....	0.15

Observations on Future Work in Blister Rust Control.

Blister rust control policy in the next three years, in New England and New York, should be to continue work on present demonstration control areas. However, as Professor Cheyney points out in his report, we must organize on a basis that will give practical results, and at the same time systematize and co-ordinate cost keeping in the various states so that definite and complete information on methods, types and results will be forthcoming. It appears to be the function of the Federal Government to provide men for cost keeping on each demonstration area because:

1. The cooperating state officials are so fully occupied in securing immediate and practical results that intensive cost-keeping either becomes a burden to them and is therefore considered an unnecessary waste of time, or

2. They hold the crew foremen so strictly to account that the latter regard the records as more important than efficient conduct of their crews, thus defeating the primary purpose of the work.

3. Unless the same records are kept for each demonstration area, cost figures for the various types, methods of work, etc., as obtained in the various states, cannot be accurately compared. Uniform record keeping can best be done by men employed and directed by the Federal Government.

Outside of the demonstration eradication areas, so far as funds permit, local control work in cooperation with the

State authorities should be encouraged in sections where further delay will result in great loss in young pine stands. The educational campaign to interest pine owners in cooperative control, which is now being carried on by the state cooperators in the New England States and New York, should be extended and made more productive of practical results. The Federal Government can assist in this educational work by issuing short circulars or post cards urging cooperative blister rust control, which can be sent out in large numbers in penalty envelopes, to land owners in pine regions in the East. A farmers bulletin, outlining present developments in control work, would also be of great value at the present time. Such a bulletin is in preparation.

Perhaps the best means of securing practical results in local control work is for each state to have one or more men trained for this special work. These men can secure accurate data on the location and value of the best pine areas, interview owners and hold meetings to arouse interest in eradicating Ribes, and organize the crews for effective work. Where a sufficient number of pine owners cooperate, the state should pay for the services of these men while they are engaged in supervising crews paid by the pine owners. In addition to making Ribes eradication more thorough, the value of a supervising officer of this kind lies in his power to force the removal of cultivated currants in the local control area, in cases where an owner refuses to cooperate and thus endangers the success of control measures. During portions of the year that Ribes erad-

ication cannot be carried on these men can spend their time profitably in determining upon the areas for the next season's work and in preliminary organization. This plan was tried in 1917 to a limited extent, in New Hampshire and Rhode Island, with excellent results.

The arguments in favor of encouraging local control in the northeastern states are that as men become trained in the work, the efficiency of wild Ribes eradication will increase and cost per acre will be reduced. The private owner can employ his regular labor force in destroying wild Ribes at times when other work is slack. It is to be expected, also, that in addition to the natural rise in stumpage values there will be a further increase in white pine values in the next twenty or thirty years, due to the destruction of young pine stands in regions where it is not feasible to eradicate Ribes. Therefore it should be profitable to protect existing stands of young pine now, rather than to wait until they are seriously damaged or destroyed by the disease. The consumer must ultimately bear the cost of producing white pine lumber, and it is cheaper to eradicate Ribes now and save existing growth, than to lose time and later add the cost of planting to the cost of eradication.

While, apparently, we have a sound basis for proceeding with control work on a reasonable scale, we need to ascertain further scientific facts, especially those bearing on the distance to which Ribes can cause the disease on pines. The policy and practice to be followed in blister rust control depends

to a very great extent on ascertaining the exact facts relative to the distance which the telio- spores of *Cronartium ribicola* travel from Ribes to pines and cause infection. To a certain extent the results in the demonstration control areas will answer this question, but only partially, because the conditions (past, present and future) governing infection and control on these areas are too complex to be exactly ascertained. Laboratory experiments to determine the vitality, rate of germination and the rate at which the telio-spores fall are of assistance, but there is no entirely satisfactory solution except that of practical experimentation under control conditions, as urged by Professor Cheyney in the report previously quoted.

This experiment would have the advantage of giving much more accurate data than we can expect from eradication areas alone. It would abundantly justify the cost but the psychological effect on the public in thus deliberately propagating blister rust infection must be considered. However, this objection does not appear to be justified in view of the fact that the experiment would be conducted in a region of general infection, as for example, in Clinton County, New York. The small chance of harm is many times counter balanced by the definite and much needed data which can only be thus obtained. The mere fact that there are now many sections of the white pine area in the east where the disease is rampant and control hopeless because of the disproportion between cost and results, war-

rants us in selecting some such area and obtaining these essential facts. The risk of damage resulting would be small and the harm no greater than would eventually result if the disease is left to take its course. Instead of a radius of 1000 feet for the Ribes-free area, as suggested by Professor Cheyney, it appears advisable to increase this distance to at least three-fourths of a mile or a mile. Also, at the center of the area, for a radius of 1000 or 1500 feet around the infected Ribes, it would be preferable to plant the pines solidly 6 feet by 6 feet or 8 feet by 8 feet, and beyond the solid planting to the edge of the Ribes-free area, run out double rows of planted pines to the eight cardinal points of the compass. A sandy tract containing sufficient State-owned land exists in New York State, and the State authorities are willing to permit this experiment to be carried out. The advantage of this location is that white pine grows well on this soil, and the wild and cultivated Ribes can be completely eradicated at moderate cost.

This experiment will furnish much needed data but it will require at least five years to secure valuable facts and still longer to obtain complete data. Meantime careful study of selected native pine infection centers should supply sufficiently reliable information to enable us to make definite recommendations to the public. Several areas of diseased native pines where only cultivated Ribes are present, or at least where wild Ribes are few and every bush can be located,

have been chosen for study. It is believed thorough study will show that, except in few and exceptional instances, teliospores do not infect for more than 1500 feet in any direction from the Ribes and that the spread has been principally in the direction of the prevailing winds. At Kittery Point, Maine, heavy pine infection lies within a radius of 700 feet south and west of the Ribes responsible for the infection.

Cooperative Experiments on Methods of Eradicating Ribes.

In the hope that cheaper methods of eradicating wild Ribes might be discovered, a series of experiments was conducted by the Office of Forage Crop Investigations, financed by blister rust eradication funds. This work was carried out by Wm. Wahlenberg under the direction of L. W. Kephart. The following is a summary of the report on this work:

The eradication work as now directed by this Bureau and the cooperating agencies, is carried on by crews of from four to fifteen men who work over a given district systematically, tearing out all of the Ribes encountered as they go. In spite of the utmost precautions, however, many of the plants are missed. The bushes usually occur scattered among the rocks and underbrush of rough woodlands, old fields, stone walls, rocky ledges, swampy places and the like, where the small, inconspicuous shrubs are easily overlooked. Furthermore, not all of the plants that are found are permanently destroyed, for when pulled out by the roots the bushes often break off at or below the surface, leaving in the soil pieces of the root or crown from which new shoots promptly arise. This aggravating occurrence is frequent with all species of Ribes in stony or rocky ground and with R. prostratum and R. triste everywhere.

As a result of not finding all of the plants and not permanently exterminating all those that are found, it is usually necessary to revisit each area from two to three times, thereby raising the total cost of the operations to an almost prohibitive figure. If some method could be devised for killing the plants outright at the first opera-

tion, it would probably be possible to reduce the number of visits and therefore the cost, by exercising the utmost vigilance during the first visit. It was largely for the purpose of finding such a method, if possible, that the experiments herein reported were undertaken.

As is usually the case when a difficult weed problem is first encountered, hopes were entertained that some chemical substance could be found that would destroy the Ribes bushes with one application. Such a substance would be exceedingly helpful in dealing with bushes growing among rocks and with the two species aforementioned. Tests were also made of all other methods of destroying the bushes that could be devised or were suggested. These included the use of various mechanical devices, trials of different methods of cutting and grubbing, grazing with goats and other live stock, burning, smothering, and combinations of the different methods.

The experimental work consisted of two phases. During the first half of the summer each scheme was thoroughly tested to determine whether or not it would be of any service whatever. As fast as it became apparent that some of the methods were hopeless they were discarded, and for the remainder of the summer the successful methods were tested in competition with each other and with ordinary hand-pulling to find out which was most suited to the different conditions under which Ribes is found. An especial effort was made to determine the cost of the different processes.

The greater part of the experimental work was performed at Hobart, Delaware county, New York, which is in the western Catskills. The plants experimented with at Hobart consisted of two species, R. cynosbati and R. oxycanthoides, the prickly and smooth gooseberries respectively. Subsequently, at Norfolk, Connecticut, the skunk currant, R. Prostratum, and swamp red currant, R. triste, were included. There is every reason to believe that similar results would be obtained with any species of Ribes. Three typical bushes were used for each experiment, each bush being marked with a wooden stake driven on the north side and bearing the number of the experiment.

Spraying the foliage.— It was known in the beginning that woody shrubs could not be destroyed by one application of poisonous spray solution upon their leaves. Such treatment simply defoliates the plants temporarily without permanent injury to the roots. It was thought, however, that by repeating the application several times the plants could be killed, in which case the method might prove serviceable for farmers and others who have only a few bushes to kill in inaccessible rock piles, where no other measure is effective.

The chemicals used were sodium arsenite, arsenic sulphid, arsenic tersulphid, sodium chloride, iron sulphate, and kerosene. Crude ammonia (ammoniacal gas liquor), sulphurous acid, and fuel oil (distillate) were to have been used but could not be obtained.

Sodium arsenite - ($1\frac{3}{4}$ oz. per gallon of water) was effective in all strengths of solution above 2 ounces per gallon and was the quickest to destroy the leaves. At the rate of 2 ounces per gallon, 1 gallon of solution was necessary for three full-grown bushes.. At the stronger concentrations a less quantity suffices. Two applications at an interval of three weeks greatly weakens but does not kill the bushes. The treatment would doubtless succeed if given persistently through two seasons. It cannot be used in grazing areas owing to the danger of arsenic poisoning.

Sodium chloride, - ordinary salt ($2\frac{3}{4}$ lbs. per gallon), reduced the leaf growth to five per cent of the original quantity in two applications. One more treatment this year and one next spring would probably kill the plants. The effect is accentuated if grazing cattle have access to the bushes, as they eat the leaves to get the salt. $1\frac{1}{4}$ quart of solution is used per plant.

Iron sulphate - copperas or green vitriol (2 lbs. per gallon), acted much like common salt, but recovery was more complete. Six or seven applications would probably be necessary to prove fatal. This material is not poisonous to cattle or to the soil.

Kerosene at the rate of 1 quart per plant causes complete defoliation and apparent death of the plants in two applications. It was the most deadly and most generally serviceable of the spray materials used.

Arsenic sulphid and arsenic tersulphid are not serviceable, owing to their low solubility and high cost.

Applying chemicals to the soil (dry); - Various chemicals that are supposed to be toxic in the soil solution were applied to the surface of the soil surrounding the bushes. This is an effective method of handling certain types of herbaceous weeds which grow in large colonies. It is hardly practicable to treat widely scattered bushes in this way, however, owing to the large quantity of material that must be transported.

Calcium chloride scattered on the ground at the rate of 43560 pounds per acre (1 pound per square foot). - Each plant draws food from a radius of about 3 feet, thus requiring about 30 pounds of the salt per plant. In three weeks the leaves on all the bushes were dead. At the end of five weeks one

plant was apparently dead while four others showed faint signs of life. The ultimate effect of the treatment can not be told until next year.

Sodium chloride applied at rate of $1\frac{1}{2}$, $2\frac{1}{4}$ and 3 tons per acre (0.0675, 0.1033 and 0.1377 pounds per square foot) or, on the basis of 30 square feet per plant, 2.025, 3.099 and 4.131 pounds per plant. - The heaviest application caused the leaves to wither, but a new crop was gradually produced. Evidently an application much heavier than these would be required to bring fatal results. Moreover, cattle are almost sure to eat the salt before it has a chance to work.

Sodium carbonate, sal soda, applied at rates of $1\frac{1}{2}$, $2\frac{1}{4}$ and $7\frac{1}{2}$ tons per acre (0.0675, 0.1033 and 0.3442 pounds per square foot) or 2.025, 3.009 and 10.326 pounds per plant. The first two applications had very little effect. The heavy application caused all the leaves to wither within ten days. One plant had failed to recover at the end of five weeks, while two others showed a very few new leaves. This method might offer some advantages for local use.

Applying chemicals to the soil (liquid). Oils and powerful chemicals that can not be evenly distributed in the dry condition must be applied as liquids. This necessitates carrying cumbersome distributing apparatus, though that disadvantage is offset in the case of chemicals by the lesser quantity of chemical needed.

Kerosene at the rates of 1, 2 and 3 quarts per plant (30 square feet). The two lightest applications only caused a reddening of the leaves. The heavy application caused the leaves to drop in three weeks, but a new crop was produced. A second application again defoliated the plants, but it is not certain that they are dead.

Crude oil at rates of 2, 3 and 4 quarts per plant (30 square feet) - Two applications at the heaviest rate caused defoliation and apparent killing of the buds. The killing effect of oil is, however, problematical.

Sodium arsenite was applied at different rates from $\frac{1}{2}$ to 2 quarts per plant in strengths varying from 1 to 10 ounces per gallon of water. No effect having resulted from the first applications, second applications were given at double the rate. The plants were defoliated but quickly recovered and the treatment was not a success. Sodium cyanide had even less effect than sodium arsenite.

Gases in the soil. Many instances have been reported of the injurious effect on plants of gases in the soil. It was thought that some way might be found to introduce gases into the soil around the roots of Ribes plants.. Such a process would be very helpful against bushes that break off in the soil. Accordingly a few of the gases that are known to be most active as root poisons were tested.

In each experiment the chemicals were placed (1) in holes near the base of the plant and (2) in holes on a circle 12 - 18 inches from the plant, to determine the most susceptible area of the root system. The depths of the holes was such as to reach the area containing the greatest quantity of feeding roots.

Carbon bisulphide: Injected with the Pal-Injector, the plants receiving from 3 to 60 cc. Each treatment was repeated after three weeks. In no case was there any effect more severe than a reddening of the leaves.

Formalin.- Treatment and results same as the above.

Turpentine, spirits.- Treatment and results same as the above.

Calcium carbide (giving off acetylene).- Buried in the soil at rates of 4 to 16 ounces per plant. No appreciable effect other than a slight rusting of foliage.

Sodium sulphide (giving off hypochlorous acid and probably free chlorine).- Same treatment and results as the above.

Sulphur dioxide and hydrogen sulphide water were to have been prepared and used, but were discarded when it became evident that the gas process was not successful.

Burning.- An attempt was made to burn the bushes by first spraying them with kerosene or crude oil. Although a quart of oil was used, and the leaves dripped, the bushes would not carry fire. After considerable effort a few branches were burned off, when the effort was given up as hopeless.

Better results were obtained, however, by first cutting off the bushes and then pouring over the stumps one-half pint of kerosene or crude oil. The stumps blazed vigorously and were consumed. No sprouts had appeared from these roots after six weeks and the treatment is held a success.

Poisoning the stumps.- When *Ribes* bushes are cut off they sprout vigorously from the crown.. To prevent this, poisons were applied to the crown immediately after cutting.

Carbolic acid (crude).- One-fourth pint checked sprouting for at least six weeks. From all appearances the plants were dead. The treatment must not be delayed more than a few hours after cutting, or sprouting may occur.

Sulphuric acid (96%).- One-half pint severely burned the crown and checked sprouting indefinitely. This experiment was not tried until late in the season and the ultimate results are not known.

Crude oil.- One-half pint did not entirely prevent sprouting and is not recommended.

Miscellaneous.- Carbon bi-sulphide on the stems.- Many shrubs and sprouts can be killed by pouring this chemical down the stem at the base. Carbon bi-sulphide is exceedingly volatile and it is thought that the rapid evaporation may result in artificial freezing of the cambium. This supposition is borne out by the fact that plants with heavy corky bark are less easily injured than those with thin membranous bark and cortex. This treatment is apparently successful. One-half pint of the liquid when poured down the bases of the stems, causes defoliation in four weeks and deadening of the buds. It remains to be seen whether the plants will ever recover. The method is open to the objection that carbon bi-sulphide is highly inflammable and the fumes nauseating, while the best method yet devised for applying the material is very slow and awkward. The latter could be remedied by the use of special apparatus.

Mechanical Methods.- A simple mechanical device that would save time or increase the effectiveness of the work, or both, would be very welcome. Ordinarily the time consumed by the crews in actually pulling out the bushes is negligible compared to the time spent in searching. Sometimes, however, the workers come across a colony of extra large plants that require a good deal of effort by several men to uproot. Whether or not it would pay to carry along a special tool to uproot such plants depends upon how frequently they are liable to be encountered. The principal use for tools, as it is with chemicals, would be when working among rocks or with *R. prostratum* and *R. triste*, where it is almost impossible to avoid breaking the plants off in the soil.

Rope with ring.- A 3/8 inch rope with an iron ring was tried for pulling out the plants. It seemed to have no advantage over hand-pulling and was somewhat slower. When a

horse is available, however, such a rope or a chain can be thrown around a large bush and the plants pulled out more rapidly than by hand.

Rope and bar.- The rope was fastened to the end of a crowbar or a stout wooden pole, which was jabbed into the ground and pulled sidewise as a lever. This required a good deal of exertion, however, and had no particular advantages.

Stake-puller.- The bar was then placed across a large stone as a fulcrum and pried down, somewhat after the fashion of the stake-pullers used in circuses. The bushes came up quickly but broke off close to the ground because the pull was vertical while the roots run out almost horizontally. With tap-rooted plants a device of this sort mounted on wheels is a very efficient instrument, but it does not work well with *Ribes*.

Grubbing.- Several of the eradication crews have experimented with grubbing with a mattock or grub-hoe but have given it up because pulling is easier and quicker. The only places where grubbing is necessary are in open fields where the bushes grow to large size and in dealing with the prostrate species of currants.

Mowing.- Mowing *Ribes* bushes with a bush-hook or axe does not injure the plants to any extent. In fact, it seems to stimulate them to the production of vigorous sprouts, much like effect of pruning an apple tree.

Mowing or pulling and spraying.- Where the *Ribes* bushes are growing among the rocks it is almost impossible to get out all of the crowns, and sprouting is certain to follow. The easiest way to handle sprouts is to spray them as described under "Spraying the foliage". In fairly easy country a man can carry a small knapsack sprayer and spray the sprouts easier than he can pull off all the sprouts from among the rocks with his fingers. Fuel oil is the most satisfactory material for this purpose.

Effects of grubbing, pulling and mowing on the production of sprouts.- The results of this experiment can not be told with certainty within a year. At the end of three weeks no evidence was found of there being any buds on the roots or on the lower part of the crown. The lowest leaf buds that developed were situated at the point where the stems come together to form the crown. From this it appears that gooseberry plants can be prevented from sprouting by grubbing or pulling out all of the crown. The evidence is not yet conclusive but it is borne out by the experience of the eradication crews. Currants, on the other hand, at least *R. prostratum* and *R. triste*, do sprout very vigorously from the roots and can not be prevented from sprouting simply by removing the crowns.

Smothering.- An attempt was made to smother skunk currant by covering the patches with cut weeds and with lopped branches.. It was necessary to cut 3 square rods of heavy weed growth in order to obtain enough material to cover one square rod of currants, while an even larger quantity of hazel brush was required. The results of this work will not be apparent until next year. In places that are more readily accessible straw or hay would probably be more convenient for this purpose. Owing to the amount of labor involved this method will probably find only local application.

Hand-pulling.- Since the main object of these experiments was to find some process that would be cheaper and more efficient than hand-pulling, an effort was made to obtain the actual cost figures of eradication. Fairly definite figures were obtained on skunk currant. On a square rod of solid currant growth the plants were pulled by hand, taking care to prevent breakage as much as possible. Seventy pieces were secured in 10 minutes of careful search. On another square rod 143 pieces were secured in 23 minutes. The significant feature of this experiment lies in the fact that a second search of the first plot yielded 7 pieces that had been overlooked. At this rate a crew covering an acre of skunk currant would leave 1120 pieces for new plants.

Summary. Out of 89 separate experiments, 13 fairly positive methods of destroying Ribes were found. These are aside from ordinary hand-pulling and grubbing. Seven methods were found for killing the upright species of Ribes at one operation. Of these, 3 require the application of large quantities of chemicals to the soil, 3 call for cutting or grubbing of the bushes and the addition of a small quantity of chemical to the stump, and 1 is a stem treatment with chemicals. No improved method was found for killing the prostrate, creeping species, nor was any efficient method found for killing the plants by means of poison sprays, poisonous gases in the soil, or mechanical contrivances.

In the accompanying table the column "number of treatments" is of especial importance, as it largely determines the cost of the treatment. A treatment that requires 10 minutes for the first time but does not need to be repeated is better than one that takes 3 minutes but must be repeated several times.

SUMMARY OF SUCCESSFUL METHODS OF DESTROYING RIBES

Method	Chemical of Implement	Quantity: Chemical: per bush	Price of Chemical:	Number of Treatments:	Total cost per bush	
					Material:	Labor
1. Spraying	Sodium arsenite	2/3 oz.	\$0.20 lb.	4	\$0.04	16 min.
2. Spraying	Sodium chloride	14 "	0.006 "	4	0.0206	12 "
3. Spraying	Iron Sulphate	8 "	0.01 "	7	0.035	28 "
4. Spraying	Kerosene	1 qt.	0.10 gal.	3	0.075	6 "
5. Spraying	*Fuel oil	1 qt.	0.07 "	3	0.0515	6 "
Chemicals on:	*Calcium					
6. soil	chloride	30 lb.	0.02 lb.	1	0.60	10 "
Chemicals on:	*Sodium					
7. soil	carbonate	15 "	0.02 "	1	0.30	6 "
Chemicals on:						
8. soil	*Crude oil	4 qt.	0.10 gal.	1	0.10	3 "
Gases in the:						
9. soil			None effective			
10. Burning stumps	Bush hook & crude (fuel or kerosene) oil	1/2 pt.	0.08 gal.	1 ?	0.005	6 "
Poisoning	Bush hook					
11. stumps	and carbolic acid (Dip oil)	1/4 "	0.60 "	1	0.02	5 "
Poisoning	Bush hook					
12. stumps	& sulphuric acid	1/2 "	0.12 pt.	1	0.06	5 "
Mechanical	Rope and					
13. methods	ring			1 ?		6 1/2 "
14. do	Mattock			2 - 4		2-20 "
15. do	Pulling			2 - 4		2-20 "
16. do	Pulling			2 - 3		30-60 min. per sq. rd.
Miscellan-	*Carbon					
17. eous	bisulphide on stem	1/2 pt.	0.20 pt.	1	0.10	5 min
18. do	Mowing or pulling & spraying	5 oz.	0.006 lb.	1 cutting 2? spraying	0.004	6 min

* Indicates methods whose positive results will not be known until next year.

Conclusions.- No improved method of destroying Ribes has been found that is available for general use. Several new ideas have been developed, however, that may prove serviceable for local use. Of the methods tested this year the following seem to offer the greatest possibilities:

1. Hand-pulling or grubbing. 2. Carbon-bisulphide treatment of stems. 3. Mowing and burning stumps. 4. Grubbing or mowing and poisoning stumps. One of the best schemes for working around rocky places is to pull up or cut off the plants, pour oil around the stumps, and set fire to them. A strong, slender and sharp brush hook is convenient for cutting the stems, while a watering can with a long, slender sprout from which the nose is removed is handy for pouring on the oil. A cheap grade of fuel oil is the best, and enough should be used to insure a complete burn. If there is too much danger of fire, the stumps can be poisoned with crude carbolic acid or sulphuric acid.. The carbon-bisulphide treatment is usually rather inconvenient. Good hand-pulling is better than anything else, if it can be thoroughly done.

Some thought has been given to the use of goats for Ribes eradication. The only place for goats in this connection is in the hands of a few farmers who may happen to have a concentrated collection of Ribes conveniently located.

The general conclusion to be drawn from these experiments and from experience in the field is that little practical benefit is to be derived by substituting other hand methods for hand-pulling. No matter what scheme is used, if it depends upon hunting down each individual plant and destroying it by hand, there will always be a certain percentage of plants that will be missed. This necessitates a second visit to all the treated areas. There seems to be no hope for this situation; it is bound to occur even with the best type of organization and most diligent of crews. Such being the case, it makes little difference if a few plants do sprout up again, for the ground must be gone over anyway, and these plants can be treated as before. There are times, of course, when the number of plants that survive the first treatment is excessive, as in the case of bushes growing on rocky ledges or along stone walls, where the plants are very difficult to uproot and often send up sprouts. A treatment that would destroy the roots once and for all would then be of great assistance. Under ordinary circumstances, however, the number of such plants is but a small proportion of the whole, and it is hardly practicable to carry along the necessary special apparatus simply for them. The extra labor that is required to exterminate such plants during the second visit is negligible. Most of the time of the crews is spent in searching rather than pulling, and they can take care of forty plants per acre almost as rapidly as they can twenty.

If Ribes grew in dense masses concentrated within a limited area, rather than as widely scattered individuals, their eradication would be a much simpler matter. The infested areas could be plowed or grubbed out in any of a number of ways. When it becomes necessary to search over a wide area to find the plants, and then treat each one separately, the problem is exceedingly difficult.

It occurs to the writers that the most feasible method of handling this question is along the lines suggested in the report by Professor Cheyney. No standard and inflexible system of destroying Ribes is possible, owing to differences in growth conditions. For this reason accurate data on methods and costs for each condition are very much needed. These could best be obtained by an experimental crew working in typical areas with the various types of organization and methods of eradication.

Recommendations.

1. It is suggested that if such an experimental crew be organized for work next year, the plans be widened to include tests of a few of the new eradication schemes that are most promising. Undoubtedly one or another of these schemes will prove useful under certain local conditions, and the only way to determine their usefulness or limitations is to try them in field practice. If it is not thought desirable to include this work with the regular experimental crew, a separate crew could be put on this project.

The methods that would be tried would be those of the Hobart experiments that appear to be successful next spring. Observations should be taken at Hobart not later than May 15 with particular attention to the following experiments:

- 10 b (cutting and burning with oil).
- 12 a (calcium chloride on the soil).
- 13 a (sodium carbonate on the soil).
- 14 a, b, c, and d (kerosene and crude oil on the soil).
- 27 a (carbon bisulphide on the stems).
- 28 a and b (cutting and poisoning with carbolic acid).
- 32 a and b (cutting and poisoning with sulphuric acid).
- 30 a and b (mowing).
- 30 c and d and 29 d (grubbing).
- 31 a (mowing and spraying).

As soon as it is decided which experiments are successful, they should be tried out on a small scale to develop the best types of implements, manner of carrying supplies, and other details for use by a large party. Such tests should not require

more than two weeks to complete, when the plans can be turned over to the experimental crew.

Two experiments remain to be conducted. The first and most important is to determine how, when, and where the different species of *Ribes* form sprouts. Do the sprouts come from the stems, crowns, or roots? At what season is sprouting least liable to occur? Does extent of sprouting vary with the soil or climatic conditions? The second is to determine the effect of soil poisons on *R. prostratum*. With these exceptions the eradication experiments have been completed.

Field Investigations:

No proof of the over-wintering of blister rust on *Ribes* has been obtained although evidence collected this year indicates that it may occasionally do so. Fruiting uredo pustules were found naturally on *R. hirtellum* and also produced artificially by inoculation upon young twigs of this season's growth. These pustules are so located upon the stem that it is uncertain whether they are thrown off with the outer coating which is shed late in the season. There are some indications that occasionally the pustule extends beneath this layer and consequently may live over winter upon the twig. (Published in Science, vol. 46, #1187, p. 314-5. Sept. 28, 1917.)

The blister rust has been found on or produced by inoculation upon the following species of five-leaved pines.

- P. strobus - Eastern white pine
- P. monticola - Western white pine
- P. Lambertiana - Western sugar pine
- P. flexilis - limber pine
- P. cembra - Stone pine (foreign).
- P. excelsa - Himalayan white pine (foreign).
- P. parviflora - Japanese white pine (foreign)

For the purpose of discovering resistant varieties or species of *Ribes*, inoculations under controlled conditions have been made during the past three years on 82 varieties of cultivated red, black and white currants, 23 varieties of cultivated gooseberries, and 48 species and hybrids of *Ribes* from various parts

of the world. Field tests are also being made with many of the above varieties and species.

The varieties of a cultivated species show considerable variation in the degree of their susceptibility to the disease. The cultivated species of *Ribes* also vary decidedly in susceptibility.. Some varieties and some species, notably *Ribes nigrum*, are very congenial hosts for the rust, very abundant uredinia and telia being produced thereon. In other varieties and species the rust spreads rapidly over the leaf surface and produces abundant uredinia, but the leaf tissue often dies before many telia are formed. In other cases a few uredinia form, at which time irregular areas of the leaf tissue die quickly, with or without further spread of the fungus around the dead area. Sometimes, instead of a definite area being killed, small streaks or flecks are killed. These dead spots often enlarge slowly, producing occasionally a few uredinia or telia. All intergradations are found between *R. nigrum*, upon which the maximum number of fruiting bodies form, and *R. leptanthum*, on which small dead areas and flecks are formed, on less than 10 per cent. of which rust spores are produced. The vigor of the plant and the age of the leaves have an influence on the development of the disease. (Published in Science, vol. 46, #1184, p. 243-4, Sept. 7, 1917).

Observations in the greenhouse on snails, weevils, sowbugs, ants and cockroaches shows that these insects frequent diseased plants and carry spores about upon their bodies. Most of them also feed upon the fruits of the fungus, including pycnia, uredo and telial pustules. In some cases the excreted spores were still viable. (Published in Phytopathology, vol. 7, #5, p. 368-375, Oct. 1917.)

Field observations developed the following facts:

(a) Squirrels eat the diseased bark from infected branches which bear the pycnidial stage, often removing the bark from extensive areas.

(b) Young Gypsy Moth larvae eat the pine blisters and their surrounding tissues, considerably reducing the number of spores

given off. However, when voided the spores still remain viable. Large numbers of spores are carried upon the bodies of the larvae. The young larvae are known to be carried for miles by the wind, thus possibly accounting for a wide distribution of the blister rust in areas where the two pests occur together. (Soon to be published in Journal of Agricultural Research).

At Kittery Point, Maine, blister rust cankers on trunks and branches, cut in November 1916 and remaining on the ground throughout the winter, produced aecia in the early part of May. This signifies that where diseased pine are cut, special attention must be given to burning them, in order to insure complete eradication. (Published in Phytopathology, Vol. 7, #5, p. 391-392, Oct. 1, 1917.)

The blister rust spores are known to travel from Ribes to Ribes for at least one-half mile and under favorable conditions they probably jumps several miles. Posey reported on August 4, 1917, that sporulating uredinia were collected on wild gooseberry on Duck Island, Isle of Shoals, Maine. No pines grow on this island and the island is located seven miles from any pines. The island is small, no one lives on it, and it appears to be seldom visited.

Preliminary tests show that sunlight kills exposed spores within a few days. Laboratory tests show that all three forms of spores may remain viable for about two months when kept in a glass vial. Spores kept in a vial out of doors lost their viability about a week earlier than did similar spores kept in a glass vial in a dark ice-box.

A study was made of the best means of preventing the spread of the blister rust through spores carried on the clothing of the men engaged in scouting. It was found that the antiseptic which had been most highly recommended, corrosive sublimate solution, will not penetrate to the interior of a spore-mass because of the film of air surrounding it. Various sterilizing agents were tested and it resulted in the discovery that strong ammonia water is effective in devitalizing the spores. The ammonia solution readily penetrates spore masses, it is cheap and easily obtained, and lacks the danger connected with the use of corrosive sublimate.

Inspectors are most likely to carry the spores on their hands and arms, hence their shirt sleeves should be rolled back when examining Ribes. If infection is found, after finishing the examination of the bushes, it is a simple and harmless operation to first wet the hands and arms with water and then rub them well with about a teaspoonful of strong ammonia water, and immediately wash this off in clear water. Also, since such spores as reach the clothing must adhere rather loosely in order to be in danger of carrying the disease to uninfected plants, it is believed that the chances of spreading the disease on the clothing will be very small if after each inspection of infected plants the clothing is brushed with a whisk broom moistened with strong ammonia water.

Discussion at the July conference made it clear that in New England, inspectors should not be required to wear a special

uniform which has to be sterilized frequently. One objection to this is that such a suit would have to be treated many times each day, possibly 30 or 40 times, causing inconvenience and great delay in the progress of the work. Since blister rust infection is general in New England and the men are principally engaged in the eradication of Ribes, it seems unnecessary to take such precautions. In localities where an attempt is being made to completely wipe out the disease, sanitation measures are desirable and have been used.

The question of securing a resistant variety of currant or gooseberry is still in need of further investigation. The facts relative to over wintering of the fungus on Ribes should be determined by transplanting thousands of heavily infected bushes (in winter condition) at some safe point in the Middle West. It is highly important to ascertain the exact facts relative to spore dissemination in all stages, since eradication in the Lake States and control in the North-east hinges on this point. Too little is known regarding the effect of seasonal and climatic variations on the degree of infection.

Blister Rust Conferences in 1917.

A conference of the state officials in charge of cooperative blister rust control in New England and New York, with representatives of the Federal Government and the executive committee of the Committee on the Suppression of Pine Blister Rust in North America, was held at Amherst, Mass., on July 17, and 18, 1917. Thirty men attended the con-

ference, and the following points were especially considered as applied to the control policy in the region of general infection:-

1. The advisability of spending much time in scouting for and attempting to eradicate pine infection.
2. The practicability of widespread eradication of cultivated Ribes without an effort to get out the wild Ribes.
3. The establishment of definite eradication areas as opposed to State-wide work.
4. The need for changes in the cooperative agreements.

The following resolutions were unanimously adopted by the conference:

1. It is the sense of this conference that the essential thing in controlling the blister rust is to get out all Ribes, that the most effective time for doing this is the early spring, and that that season should also be used for rescouting control areas.

2. It is the sense of this conference that it is not feasible to spend time and money in scouting and eradicating diseased pine in New England, except where there may be outbreaks of the disease in new territory.

3. Resolved, that we regard the establishment of control areas, in which all Ribes both wild and domestic shall be eradicated as far as possible, to be the most practicable means of limiting the ravages of white pine blister rust; and that we urge owners of pine woods to co-operate with state authorities to control the disease in their several localities.

4. Resolved, that in the expenditure of funds appropriated for blister rust work, this conference approves; 1. The method of direct state experiment areas to determine the cost of control by means of the eradication of wild and domestic Ribes under various conditions; and 2. Such co-operation with private owners as will give expert direction or supervision to their work.

5. It is the sense of this conference that localities established as control areas should be scouted at least four successive years for Ribes.

6. It is the sense of this conference that all men inspecting should be required to carry whisk brooms and to brush their entire clothing with these after dipping them in-



to disinfectant when circumstances require, also thoroughly to wash their hands and arms.

The Committee on the Suppression of the Pine Blister Rust in North America, at its annual conference held at
1917
Pittsburgh, November 12 to 13, placed itself on record as follows:

1. The division of the problem into three separate geographical areas remains the same as last year. In New England, the problem is one of working out practical methods of control which can be employed by owners of woodland, with the aid and supervision of the State and Federal Governments. In the Middle West, the problem is still one of eradication of the disease and prevention of its spread. In the far West, it is one of determining whether the rust has anywhere obtained a foothold, and of keeping out of that region all plant materials likely to introduce the disease.

In order that these problems may be effectively met and a great natural resource thereby protected from ultimate destruction this Committee urges the continuance of the same appropriation made last year by the Federal Government, of adequate appropriations by the States and of the fullest cooperation between the Federal Government, the several States, and towns and private owners in continuing the fight.

2. The white pine blister rust fungus has now been found so generally distributed throughout the New England States and New York, as to render its total eradication from those States most improbable. In the opinion of this organization, therefore, the policy of these States should be:

First; to prosecute vigorously experiments calculated to determine the practicability of control measures. Control areas already established or to be established, should be considered as purely experimental, and in no case as predicting a policy of State wide eradication.

Second, to continue such educational work as may seem necessary ultimately to insure the cooperation of private owners in the control work.

Third, to secure as rapidly as possible the active cooperation of private owners in the protection of their pine lands.

3. This organization urges the prompt enactment of a Federal law which will place an absolute prohibition on the importation from foreign countries of nursery stock as defined



by the plant quarantine act of 1912, with the provision that the Federal Department of Agriculture may import, propagate, grow under quarantine conditions, and distribute any species and varieties which it may deem desirable.

The Committee believes that the lesson of the introduction and spread of the blister rust, as well as many other plant diseases and insect pests which are now causing losses mounting into millions of dollars annually, will be lost unless this action is taken in its entirety without delay.

4. This Committee owes a vote of thanks to the Pittsburgh Chamber of Commerce for its courtesy in allowing the use of its rooms for these meetings, and the Secretary is hereby instructed to express its thanks and appreciation to said organization.

The Executive Committee is hereby requested to communicate with one or more members of the main committee in each state and Province with a view to securing contributions toward the actual expenses of this organization from any source available.

Resolution proposed by Mr. Paul, and adopted.

Resolved: that in addition to eradication within any pine area, this committee is of the opinion from evidence so far obtained that in the future serious loss from a commercial standpoint is not to be expected if the area is surrounded by a Ribes-free zone one-third of a mile in width.

Educational.

One hundred thousand posters, depicting in color the life history and effects of the blister rust on pine and Ribes, with a brief description of the disease, have been printed. They will be distributed in states having no funds in which and the Federal Government is directing scouting for blister rust, A special campaign is being made to introduce these posters into public schools and secure the assistance of teachers and pupils in locating outbreaks of the disease.

Nine states with appropriations for blister rust work have also obtained a total of 63,000 of these posters, with appropriate changes in the printed matter. Maine and New Hampshire distributed unillustrated posters which proved very useful, especially in control areas.

New York State sent out 20,000 copies of a large post card, on one side of which a specimen of diseased native pine, in the fruiting stage, is shown in colors, and on the opposite side is a brief description of the disease. A similar card was prepared on which was reproduced in color the leaves of the red and flowering currant, showing the rust on the under side. The color work on these cards is very good and the plan appears to be a highly effective method of disseminating knowledge concerning the blister rust.

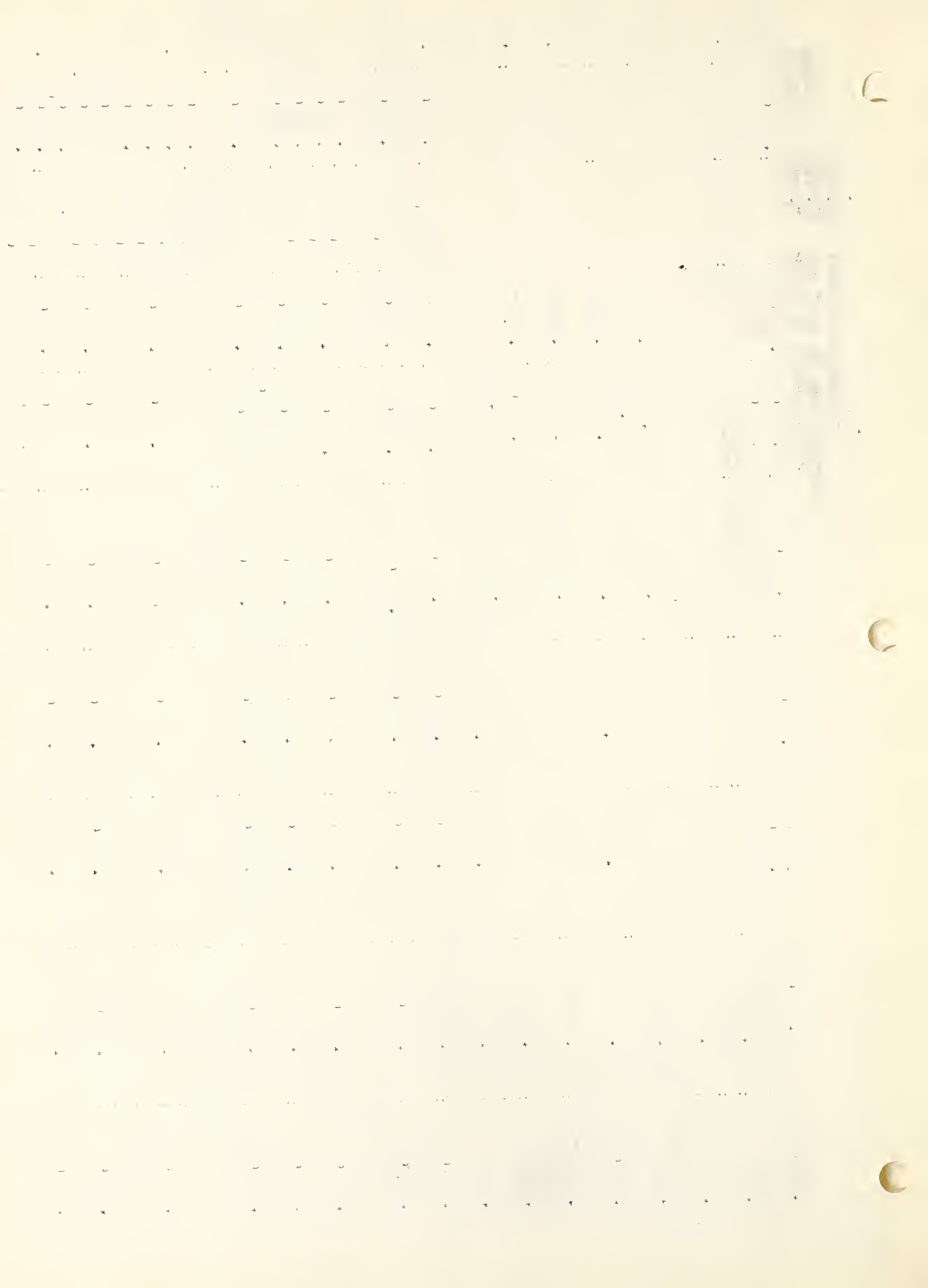
In some states County agents have become interested in the campaign against the blister rust. Their aid has been of great value in assisting the scouts in their work and in arousing public interest.

Newspapers, forestry magazines, and other periodicals have ably conducted publicity work by giving prominence to the efforts which have been made in the fight against this disease. Thousands of copies of Farmers Bulletin 742, and state publications on the blister rust have been distributed.

1 March to November 30, 1917

State:	Appro-	To Year	Amts.to be expend-	Amt.expended	Total expend-:	Excess of	Total expend-	Grand total
:	pria-	: Ending	: ed as stated in	: to date by	: ed by U.S.D.A.	: State expend-	: ed by U.S.D.A.	: expenditures
:	tions	:	: 1917 cooperative	: State (from	: to date on	: iture over	: to date on	: U.S.D.A.
:	:	:	: Agreement	: State reports)	: e/c 45	: e/c 45	: e/c 645	:
:	:	:	: State	: U.S.D.A.	:	:	:	:
Me.	5,000.	Dec.31'17:	\$2,500.to :	\$3,000.	\$ 2,220.69	\$ 779.31	\$ 515.76	\$ 2,736.45
N.H.	8,000.	Aug.31'17:	:	:	:	:	:	:
:	10,000.	" "19:	:	10,390.18	6,652.77	3,737.41	2,251.91	8,904.68
:	3,000.	Jul.1,'17:	:	:	:	:	:	:
:	5,000.	" "16:	:	3,173.15	4,016.30	-843.14	934.94	4,951.24
Vt.	2,000.	" "19:	:	:	:	:	:	:
:	15,000.	" "19:	:	:	:	:	:	:
Mines:	50,000.	Fiscal yrs	:	36,328.15	34,002.37	2,325.78	8,373.80	42,376.17
R.I.	2,500.	Fiscal yr	:	1,432.65	* 2,519.70	-1,087.05	594.43	3,114.23
Conn:	7,500.	Sep.31'17:	:	7,423.67	3,064.32	4,359.29	3,225.97	6,290.35
:	7,500.	" "19:	:	:	:	:	:	:
N.Y.	25,000.00	Fiscal year '17:	28,000.	46,293.47	22,185.49	24,107.98	3,064.40	25,249.89
Pa.	10,000.	" "17-18:	2,400.	3,605.82	1,291.40	1,314.42	893.48	3,184.88
N.J.	:	:	:	:	428.48	- 428.48	318.23	746.71
Id.	:	:	600. to	950.00	:	:	588.60	588.60
Id.	:	:	950.	1,200.	:	:	:	:
Va.	:	:	800.	800.	:	:	858.00	858.00
W.Va.	:	:	500.	500.	822.10	- 322.10	249.25	1,071.35
N.C.	:	:	300. to	300.	:	:	772.11	772.11
S.C.	:	:	:	:	:	:	36.54	36.54
Ga.	:	:	:	:	:	:	67.08	67.08
Totals:	170,500.	:	114,450.	114,400.	112,601.28	-2,680.77	22,744.50	99,948.28

*Includes \$927.74 for salary and expenses of field agent in charge of state work, per cooperative agreement.

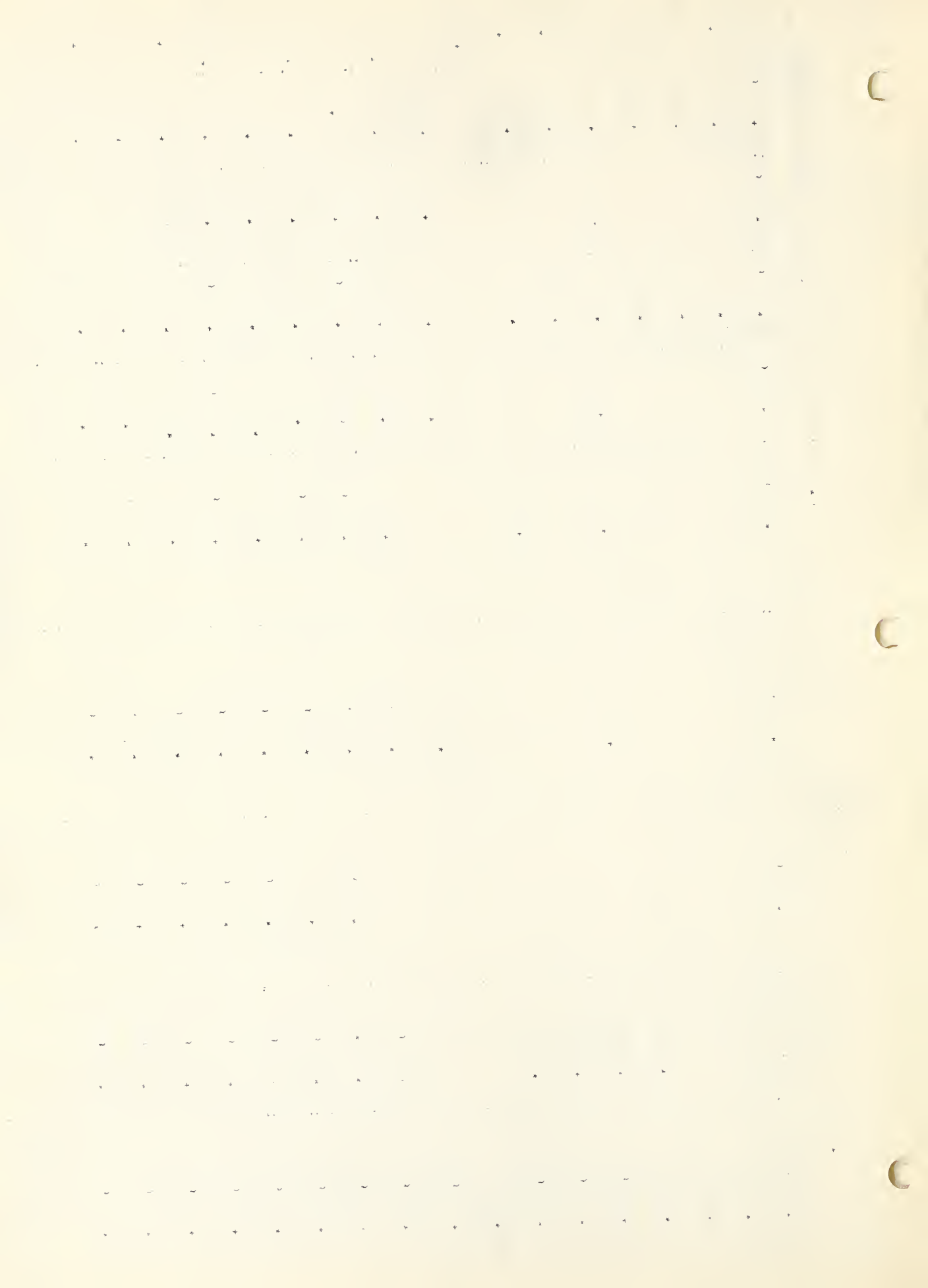


RECAPITULATION OF BLISTER RUST EXPENDITURES (STATE AND GOVERNMENT) IN EAST, 1917.

States, March 5th November 30 1917

: Amt. expended by U.S.D.A. in opera-		: Amt. expended by U. S.: D. A.		: Amt. State Cre-: Amt. expend-: Est. amt. State	
State: tions not directed by the state		: in State directed operations		: dits U.S.D.A. : ed by State: funds to be met	
: Direct	: Interstate	: Indirect	: s/c 645	: Intrastate	: a/c 45
: a/c 645	: a/c 45	: a/c 645	: a/c 45	: a/c 45	: ing to date.
Me. : \$ 143.43 :	\$ 168.62 :	\$ 82.10 :	\$ 203.71 :	\$ 2,138.59 :	\$ 2,500.00 :
N.H. : 202.42 :	624.34 :	248.53 :	1,425.15 :	6,404.24 :	7,380.50 :
Vt. : 396.68 :	665.69 :	294.26 :	150.30 :	244.00 :	3,200.31 :
Mass. : 2,163.52 :	793.18 :	2,755.23 :	1,093.02 :	4,248.23 :	32,116.17 :
R.I. : 290.34 :	452.66 :	193.84 :	94.40 :	110.35 :	1,972.64 :
Conn. : 33.47 :	32.32 :	665.00 :	114.56 :	2,527.50 :	2,917.50 :
N. Y. : 664.75 :	756.26 :	1,288.90 :	838.94 :	1,110.75 :	20,540.29 :
Penn. : 322.02 :	53.95 :	188.96 :	48.15 :	382.50 :	1,189.30 :
N. J. : 247.06 :	24.24 :	71.17 :	15.93 :	388.31 :	388.31 :
Del. : :	:	:	:	:	:
Md. : 35.50 :	80.24 :	473.06 :	:	:	:
Va. : 747.03 :	110.95 :	:	:	:	:
W. Va. : 94.49 :	431.43 :	64.76 :	30.67 :	30.00 :	360.00 :
N. C. : 658.77 :	113.34 :	:	:	:	:
S. C. : 30.25 :	6.29 :	:	:	:	:
Ge. : 48.25 :	8.83 :	:	:	:	:
TOTALS : 6,078.00 :	3,209.73 :	6,634.73 :	2,716.60 :	10,815.25 :	71,227.35 :
					77,540.57 :
					112,591.28 :
					129,700.00 :

* - Indicates cost of Nursery Inspection, etc., is added to blister rust appropriation in agreement figures.



TOTAL BLISTER RUST APPROPRIATIONS (To Nov. 30, 1917)

RECAPITULATION

	: Amt. expended on a/c 645. : : 1917 :	Total direct expen- : se, 1918 :	Grand total expended :	: Amt. expended on a/c 645 : : 1918 :	Total expended on a/c 645 : : a/c 645 :	: Amt. expended on a/c : : 45, 1918 :
Ariz. :		1,311.49 :	1,311.49 :	1,311.49 :	1,311.49 :	
Ark. :		597.98 :	597.98 :	597.98 :	597.98 :	
Colo. :	1,573.58 :	4,437.49 :	6,011.07 :	4,437.49 :	6,011.07 :	
Conn. :	2,492.97 :	3,017.82 :	5,510.79 :	68.00 :	2,560.97 :	2,949.82
Gen. :	6,287.78 :	10,383.39 :	16,671.17 :	7,032.64 :	13,320.42 :	3,350.75
Ga. :	30.25 :	28.00 :	58.25 :	28.00 :	58.25 :	
Idaho :	329.29 :	1,231.75 :	1,561.04 :	1,231.75 :	1,561.04 :	
Ill. :	433.15 :	899.50 :	1,332.65 :	899.50 :	1,332.65 :	
Ind. :	54.08 :	306.76 :	360.84 :	306.76 :	360.84 :	
Iowa :	652.68 :	807.20 :	1,459.88 :	807.20 :	1,459.88 :	
Kans. :	105.83 :	91.83 :	197.66 :	91.83 :	197.66 :	
Ky. :		160.14 :	160.14 :	160.14 :	160.14 :	
Maine :	317.68 :	2,168.05 :	2,485.73 :	29.46 :	347.14 :	2,138.59
Md. :	282.70 :	225.66 :	508.36 :	225.66 :	508.36 :	
Mass. :	4,701.33 :	33,826.59 :	38,527.92 :	917.24 :	5,618.57 :	32,909.35
Mich. :	1,898.04 :	4,798.25 :	6,696.29 :	4,618.25 :	6,516.29 :	180.00
Minn. :	4,357.25 :	11,274.27 :	15,631.52 :	4,942.60 :	9,299.85 :	6,331.67
Miss. :		277.31 :	277.31 :	277.31 :	277.31 :	
Mo. :	36.82 :	207.72 :	244.54 :	207.72 :	244.54 :	
Mont. :	850.27 :	2,021.26 :	2,871.53 :	2,021.26 :	2,871.53 :	
Nebr. :	372.33 :	388.22 :	760.55 :	388.22 :	760.55 :	
N.H. :	1,541.47 :	6,490.34 :	8,031.81 :	86.10 :	1,627.57 :	6,404.24
N.J. :	247.06 :	412.55 :	659.61 :		247.06 :	412.55
N.Mex. :	555.25 :	1,166.98 :	1,722.23 :	1,166.98 :	2,822.23 :	
N.Y. :	1,369.67 :	21,752.38 :	23,122.05 :	405.83 :	1,775.50 :	21,346.55
N.C. :	457.14 :	201.63 :	658.77 :	201.63 :	658.77 :	
N.Dak. :		124.14 :	124.14 :	124.14 :	124.14 :	
Ohio :	667.16 :	1,918.35 :	2,585.51 :	1,435.95 :	2,103.11 :	482.40
Okla. :		466.40 :	466.40 :	466.40 :	466.40 :	
Pa. :	562.03 :	1,385.74 :	1,947.77 :	142.49 :	704.52 :	1,243.25
R. I. :	385.99 :	2,440.00 :	2,825.99 :	14.70 :	400.69 :	2,425.30
S. C. :	30.25 :		30.25 :		30.25 :	
S.Dak. :		282.75 :	282.75 :	282.75 :	282.75 :	
Tenn. :		155.12 :	155.12 :	155.12 :	155.12 :	
Texas :		821.18 :	821.18 :	821.18 :	821.18 :	
Utah :		72.52 :	72.52 :	72.52 :	72.52 :	
Vt. :	512.23 :	3,994.45 :	4,506.68 :	128.45 :	640.68 :	3,866.00
Va. :	373.56 :	373.49 :	747.05 :	373.49 :	747.05 :	
Wash. :	50.46 :	50.88 :	101.34 :	50.88 :	101.34 :	
W.Va. :	94.49 :	881.43 :	975.92 :	90.00 :	184.49 :	791.43
Wis. :	1,970.14 :	4,378.88 :	6,349.02 :	79.89 :	2,050.03 :	4,298.99
Wyo. :	366.25 :	723.65 :	1,089.90 :	723.65 :	1,089.90 :	
General :	32,645.63 :	125,985.22 :	158,630.85 :	36,881.20 :	71,381.83 :	89,104.02
Meinecke :	4,974.23 :	9,815.07 :	14,789.30 :	6,491.19 :		3,323.88
	27,671.40 :	116,170.15 :	143,841.55 :	30,390.01 :		85,780.14
Meinecke :	2,225.50 :	6,500.00 :	8,725.50 :	6,500.00 :	8,725.50 :	
	29,896.40 :	122,670.15 :	152,567.05 :	36,890.01 :	80,107.33 :	

Cal.
La.
Oregon

Summary of Present Situation.

In summing up the situation we have certain aspects of the case which may be regarded as favorable for the control of the disease. These may be enumerated briefly as follows:

1. The essential freedom of the western states from the disease.

2. The fact that two large areas in Minnesota, one in Wisconsin, one in New York, and several small areas in Pennsylvania, Ohio, and Indiana have been apparently freed from the disease.

3. The fact that the infections found in the middle territory this season are old and not infections which have gotten loose since control measures were inaugurated.

4. Further research also substantiates the idea that the progress of the disease is slow, that is, slow compared to the progress of a disease which has no alternate host. The much-studied infection at Kittery Point, Maine, is apparently 15 years old and yet the number of trees infected within the entire eradication area of 3 square miles does not at the present time apparently exceed 10 per cent of the whole number; although infection is complete in the immediate vicinity of oldest infection.

5. Still more hopeful for the continued growing of white pine is the fact that in areas where the disease is generally prevalent local control measures can be inaugurated at any future time by the elimination of Ribes. For example,

if in a given area it should not be practicable at the present time to attempt the eradication of Ribes, and the disease should become established there; if at some future time the increasing value of white pine stumpage or other considerations should make the removal of Ribes practicable, the work could be undertaken and planting and normal reproduction developed, since the disease already present upon white pine trees would not spread to other white pines in the absence of the intermediary host.

On the other hand, there are certain considerations which are unfavorable for the control of the disease. The first of these is the potential western spread of the disease across New York and westward from Ontario. It does not seem practicable under our political and social system to carry out the immune zone idea in order to block any large movement of any disease or pest, and this being the case it is necessary to calculate the time element in the western spread of the disease in figuring the value of eradication of advance infections. The other considerations opposed to control of the disease are temporary, but none the less serious. Both countries concerned are at war; and in consequence help is scarce, particularly the temporary help for the growing season which is required in this work. During the present season we have experienced the greatest difficulty in securing men at a reasonable price for the work and holding them. We have been compelled in many cases to employ inferior men. Many have enlisted, many have been drafted and not a few resigned to accept more lucrative or more permanent employment in industrial lines. We may expect that for the

period of the war this condition will grow worse instead of better.

West of the Mississippi River the same program of scouting and tracing suspicious nursery stock that has been carried on during the past year must be continued. In the area from the Mississippi River to the Hudson River we should continue the eradication of advance infections and follow up nursery stock in the areas not now known to be infected. East of the Hudson River, however, our policy should be that of purely local control, which must be undertaken in favorable localities of various types on an experimental basis, particularly with a view to determine as soon as possible the financial factors involved in the control work.

In conclusion we must reflect that the fundamental error was made when European nursery stock of white pine was imported to this country and its extensive importation encouraged. Our problem in this, as in the case of the many other diseases and pests from foreign countries that have been allowed to establish themselves, is to make the best of a very bad situation. The white pine blister rust has invaded the country and dug itself in. It will never be driven out. Our task is to limit its further spread so far as possible and control it locally in whatever way is most consistent with sound forest economics. In the meantime we should not be unmindful of the fact that ornamental and forest tree nursery stock of other species is still being imported and distributed promiscuously, and the door is wide open for the establishment of other pests and diseases, which may be quite as serious as the chestnut blight or the white pine blister rust.

APPENDIXState Laws and Quarantines Relating to Blister Rust Control.

The laws for states having appropriations for control of white pine blister rust in 1917, are as follows:

Maine

Chapter 178, Public Laws of 1917

Section 1. That the fungous disease commonly known as the white pine blister rust is hereby declared to be a dangerous pest in all its stages; and it is the duty of the officials hereinafter named, to prosecute the measures hereinafter specified for the control of this pest.

Section 2. The forest commissioner is hereby authorized and empowered to promulgate by letter, publication, poster or other means, information concerning the white pine blister rust and to designate by the aforesaid means of promulgation, areas within the state in which control measures are necessary or advisable. It shall be the duty of every land owner within such designated area, to carry out such control measures as are ordered by the forest commissioner, including the removal and destruction of any or all plants of the genus ribes, commonly known as currants and gooseberries, and any white pine tree or trees, which are found to be infected with the disease. If the owner fails to destroy the above named plants or trees within the time specified by the forest commissioner the forest commissioner shall cause said plants or trees to be destroyed and shall charge the actual expense of same to the city, town or plantation within which said plants or trees are found. Such amount shall be collected as a state tax and credited to the appropriation for said purpose. The city, town or plantation wherein such plants or trees are found may assess the cost of the removal of said plants or trees to the owner of the real estate wherein the said plants or trees are found. The amount so assessed shall be collected in the form of a tax.

Section 3. The forest commissioner or his authorized agents shall have the right to enter upon any private or public lands to determine the presence or absence of the white pine blister rust in any of its stages, and to carry out the necessary eradication measures. The above mentioned commissioner may cooperate with departments of the Federal government, the State Department of Agriculture and the Agricultural Experiment Station for the control or eradication of said disease in the state, and for the carrying out of such investigations as are deemed advisable by the commissioner.

Section 4. Any white pine trees or currant or gooseberry bushes which are found to be infected with *cronartium ribicola* are hereby declared to be a public menace and any such diseased trees or plants and any and all wild plants of the genus *ribes*, may be destroyed by order of the commissioner or his authorized agents.

If within any designated area as specified in section two of this act, currant or gooseberry bushes or white pine trees which are not infected with *cronartium ribicola* are designated by the commissioner or his agents for destruction, and destroyed by their specific order, the owner may be compensated therefor; the damages to be assessed by the commissioner or his agents at not to exceed the actual value of the material destroyed, and paid to said owner by the state treasurer upon authorization of the commissioner. In lieu of money damages for any trees or bushes destroyed under this act the commissioner may offer and the owner may accept forest planting stock to be furnished from the State Forest Nursery, and to be paid for at cost by the commissioner.

Section 5. The State Nursery Inspector, under direction of the commissioner of agriculture, is hereby authorized and empowered to enter upon any land contiguous to or within the vicinity of any nursery within the state, for the purpose of determining the presence or absence of *cronartium ribicola* in any of its stages or other threatening fungous disease or insect pest, and within such area he shall have the same power and duties for control and eradication of the white pine blister rust or its hosts as is vested in the forest commissioner or his agents, and shall have the power to enforce and carry out necessary measures for the control or eradication of other threatening fungous diseases or insect pests.

Section 6. The forest commissioner is hereby authorized and empowered to prohibit and prevent or to regulate the entry into the State of Maine or movement within the state from any part thereof to any other part, of any living five-leaved pine trees or any plants of the genus *ribes*, or other nursery stock or plants, which in his judgment may cause the introduction or spread of a dangerous plant disease or insect pest. The said official is hereby authorized to issue such orders, notifications and permits as may be necessary to carry out the provisions of this section, and any person violating any of the provisions of sections five and six shall be subject to a fine of not more than twenty dollars for each and every offense.

New Hampshire.

An Act for the Control of the White Pine Blister and
Other Fungus or Insect Pests.

Be it enacted by the Senate and House of Representatives
in General Court convened:

Section 1. That the fungous disease, *cronartium ribicola*, commonly known as the white pine blister, is hereby declared to be a dangerous fungous pest in all its stages; and it shall be the duty of the officials hereinafter named, to prosecute the measures hereinafter specified for the control of this pest.

Section 2. The state forester, under the direction of the Forestry Commission, is hereby empowered and authorized to promulgate by letter, publishing, posting or other means, information concerning the white pine blister and to designate by the aforesaid means of promulgation, areas within the state in which control measures are necessary or advisable. It shall be the duty of every landowner within such designated area, to carry out such control measures as are ordered by the state forester, including the removal and destruction of any or all plants of the genus *ribes*, commonly known as currants and gooseberries, and any white pine tree or trees, which are found to be infected with the blister. If such eradication is not begun forthwith by the property owner, the state forester or his authorized agents are hereby empowered to remove and destroy any or all currants and gooseberry bushes or diseased white pine trees from any public or private land within any such designated area; and within such area no person shall plant any currant or gooseberry bush or five-needled pine tree without the permission of the state forester.

Section 3. The state forester or his authorized agents shall have the right to enter upon any public or private property to determine the presence or absence of the white pine blister in any of its stages, and to carry out the necessary eradication measures. The Forestry Commission and state forester may co-operate with departments of the federal government, the state Department of Agriculture, and the Agricultural Experiment Station for the control or eradication of said disease in the state generally, and for the carrying out of such investigations as are deemed advisable by the commission.

Section 4. Any white pine trees or any currant or gooseberry bushes which are found to be infected with *cronartium ribicola* are hereby declared to be a public pest and any such diseased trees or plants and any and all wild plants of the genus *ribes*, may be destroyed by order of the state forester or his authorized agents. If within any designated area, as

specified in section 2, currants and gooseberries or white pine trees which are not infected with *cronartium ribicola*, are designated by the state forester or his agents and destroyed by his or their specific order, the owner may be compensated therefor; the damages to be assessed by the state treasurer upon authorization of the Forestry Commission. In lieu of money damages for any trees or bushes destroyed under this act the state forester may offer and the owner may accept forest planting stock to be furnished from the state forest nursery.

Section 5. The state nursery inspector, under the direction of the commissioner of agriculture, is hereby authorized and empowered to enter upon any land contiguous to or within the vicinity of any nursery within the state, for the purpose of determining the presence or absence of *cronartium ribicola* in any of its stages or other threatening fungous disease or insect pest, and within such area he shall have the same power and duties for the control and eradication of the white pine blister or its hosts as is vested in the state forester under sections 2 and 3 of this act, and shall have the power to enforce and carry out necessary measures for the control or eradication of other threatening insect pests or fungous diseases.

Section 6. The state nursery inspector, or the deputy commissioner of agriculture in charge of insect suppression, under the direction of the commissioner of agriculture, is hereby empowered to prohibit and prevent or regulate the entry into the State of New Hampshire or the movement within the state from any part thereof to any other part of any living five-leaved pine trees or any plants of the genus *ribes*, or other nursery stock or plants, which in his judgment may cause the introduction or spread of a dangerous insect pest or plant disease. The said officials are hereby authorized to issue such orders, notifications and permits as may be necessary to carry out the provisions of this section, and any person violating any of the provisions of sections 5 and 6 shall be subject to the same penalty as specified in section 7 of chapter 43, Laws of 1903. The expenses necessary for carrying out sections 5 and 6 of this act shall be paid from the appropriation for nursery inspection or other funds of the Department of Agriculture.

Vermont.

An Act in Amendment of and in Addition to No. 18 of the Acts of 1915 Relating to the Suppression of Fungus Diseases of Plants.

It is hereby enacted by the General Assembly of the State of Vermont:

Section 1. Section 1 of No. 18 of the acts of 1915 (Sec. 425 of the General Laws, as proposed) is hereby amended so as to read as follows:

Sec. 1. (Sec. 425 G. L.) Said commissioner may, with the approval of the board of control, use such means as it deems necessary to exterminate or prevent the introduction of the San Jose scale, the gypsy moth, the brown-tail moth and any other threatening and unusual insect pest or fungus disease found to be injuring vegetable growth.

Sec. 2. Section 2 of No. 18 of the acts of 1915 (Sec. 425 of the General Laws, as proposed) is hereby amended so as to read as follows:

Sec. 2. (Sec. 425 G. L.) Said commissioner, his duly authorized agents, and employees of the United States, engaged in the extermination of injurious insects or fungus diseases, may enter upon any of the lands in the state on which there are trees, shrubberies or vegetable growth and make examinations as to the presence of San Jose scale, the gypsy moth, brown-tail moth or any other threatening and unusual insect pest or fungus disease; and, in case any such pest or fungus disease is found, said commissioner may, by an order in writing, direct the owner or occupant of such lands to spray such trees and shrubbery as in such order directed, to destroy the same, or to take such other means to exterminate such pests or fungus diseases as said commissioner shall direct in such order, and, in case such owner or occupant neglects, after receiving such order, to carry out the directions thereof, said commissioner may use such means as he deems effectual to exterminate such pests or fungus diseases.

Sec. 3. Section 3 of No. 18 of the acts of 1915 (Sec. 425 of the General Laws, as proposed) is hereby amended so as to read as follows:

Sec. 3 (Sec. 425 G. L.) Said commissioner shall have authority to investigate unusual outbreaks of native insects or fungus diseases with the view to securing information for the use of the public as to the practical methods of protection from such insects or fungus diseases.

Sec. 4. Whenever any threatening or unusual insect pest or fungus disease is found to be doing damage to vegetable growth in any part of the state the commissioner of agriculture may take control of certain areas designated by him threatened by such insect or fungus disease; and for the purpose of preventing the spread of such insects or diseases may enter upon lands and destroy vegetable growth affected thereby; and he may in such designated area destroy the host of any animal or plant disease.

Sec. 5. Whenever in the suppression of such insect pest or fungus diseases it becomes necessary for the commissioner to destroy the host of such pest or disease, compensation shall be made as follows: the commissioner and owner of the lands upon which such plants are destroyed shall, if possible, agree upon the price to be paid as compensation therefor. In the event of the inability of said commissioner and owner to agree thereon, compensation shall be determined by the selectmen of the town in which such land lies, and the compensation agreed upon shall be paid by the auditor of accounts upon the award of such commissioner or selectmen; but no compensation shall be made for disease, wild or uncultivated trees, plants or shrubbery which are ordered destroyed on account of disease or infection.

Sec. 6. The sum of ten thousand dollars is hereby appropriated to be expended under the direction of the commissioner of agriculture in controlling and suppressing the white pine blister rust disease; three thousand dollars of this sum shall be available for the fiscal year ending July 1, 1917, five thousand dollars for the fiscal year ending July 1, 1918, and two thousand dollars for the fiscal year ending July 1, 1919. The additional sum of fifteen thousand dollars is hereby appropriated for the same purpose, which may be expended during the biennial period ending June 30, 1919, only upon the certificate of the governor.

Sec. 7. This act shall take effect from its passage. Approved April 7, 1917.

An Act Relating to the Control and Suppression of Insect Pests and Fungus Diseases of Plants.

It is hereby enacted by the General Assembly of the State of Vermont:

Section 1. A person who intentionally interferes with or hinders the work of the commissioner of agriculture in the extermination of the San Jose scale, gypsy moth, brown tail moth, or any other threatening or unusual insect pest or fungus disease found to be injuring vegetable growth; or a person who brings or causes to be brought, or ships or causes to be shipped into the state plants or shrubberies contrary to the regulations which may be made by said commissioner,

in accordance with the provisions of No. 18 of the acts of 1915 as amended by an act of the General Assembly of 1917, entitled "An act in amendment of and in addition to No. 18 of the acts of 1915 relating to the suppression of fungus diseases of plants," approved April 10, 1917, shall be imprisoned not more than three months or fined not more than \$100, or both.

Section 2. This act shall take effect from its passage.

Approved April 12, 1917.

Massachusetts.

Chapter 507, Acts of 1912, as Amended by Chapter 161, Acts of 1915, Chapter 91, Acts of 1916 and Acts of 1917.

Be it enacted, etc., as follows:

Section 7. The state nursery inspector, either personally or through his deputies, may inspect any orchard, field, garden, roadside or other place where trees, shrubs or other plants are growing out of doors, either on public or private land, which he may know or have reason to suspect is infested with the San Jose scale or any serious insect pest or plant disease, when in his judgment such pests or diseases are liable to cause financial loss to adjoining owners; and may serve written notice upon the owner, or owners, occupant or person in charge of trees, shrubs or other plants thus infested, of the presence of such pests or plant diseases, with a statement that they constitute a public nuisance, together with directions to abate the same, giving the methods of treatment for the abatement thereof, and stating a time within which the nuisance must be abated in accordance with the methods given in the notice. If the person or persons so notified shall refuse or neglect so to treat or destroy such trees, shrubs or other plants within the time prescribed, the state nursery inspector may cause such property to be so treated, or destroyed, and may employ all necessary assistants for this purpose, and such assistants shall have the right to enter upon any public or private property, if such entry is necessary for this purpose. Upon the completion of said treatment the state nursery inspector shall certify in writing to the owner or person in charge of the treated property the amount of the cost of such treatment, and if this be not paid to the secretary of the state board of agriculture within ninety days thereafter, the same may be recovered by suit, together with the costs of suit.

Section 8. In case of objection to the action of the state nursery inspector or his deputy in executing any provision of this act, an appeal may be taken within ten days to the Secretary of the state board of agriculture, and the appeal shall act as a stay of proceedings until it has been heard and decided

by the secretary of the state board of agriculture, whose decision shall be final.

Section 9. When the secretary of the state board of agriculture has heard an appeal and has rendered a decision that the action of the state nursery inspector from which the appeal was taken is sustained, the state nursery inspector shall notify in writing the owner or owners, occupant or person in charge of the trees, shrubs, or other plants concerned, of the decision of the secretary, and shall direct him or them within a given time to treat or destroy the trees, shrubs or other plants in accordance with a method prescribed in the notice. If the person or persons so notified shall refuse or neglect so to treat or destroy such trees, shrubs or other plants within the time prescribed, the state nursery inspector may cause such property to be so treated, or destroyed, and the cost of the treatment to be collected as provided in section seven of this act.

Section 10. Any person, firm or corporation violating any provision of this act or offering any hindrance to the carrying out of any part thereof, shall be punished by a fine of not less than ten or more than one hundred dollars for each offence.

Section 11. All prosecutions under the provisions of this act shall be instituted by the secretary of the state board of agriculture and shall be directed by him, and all penalties and costs recovered for the violation of any provisions of this act shall be paid to the secretary of the state board of agriculture, and by him immediately paid into the state treasury, to be kept as a fund for the use of the state nursery inspector in the enforcement of this act and as an addition to the appropriation provided for in this act, to be drawn from the treasury in the same manner as said appropriation.

Section 12. The state nursery inspector, with the approval of the secretary of the state board of agriculture, may prohibit for such periods and under such conditions as in his judgment may seem necessary, the delivery within the state of nursery stock from any other state, province or country when in his opinion such nursery stock is liable to be infested with insect pests or diseases not already present in this state. He, with the approval of the secretary of the state board of agriculture, shall have power to prescribe such general requirements as may be needed to carry out the provisions of this act, and may publish information about such insects and diseases as are concerned in this act.

Section 13. No provision of this act shall be considered as applying to the gypsy or brown tail moths or any stage thereof except upon places where nursery stock is grown and upon property immediately adjoining the same.

Section 14. The state nursery inspector shall determine the season for inspecting nurseries and the forms of certificates to be given, but in no case shall he issue a certificate which shall continue in force after the first day of July next following the date of inspection. He, or any of his deputies, shall at all times have the right to enter any public or private grounds in the performance of any duty required by this act. The state nursery inspector shall receive five hundred dollars annually for his services under this act and his travelling and other expenses necessarily incurred in his service hereunder. Each of his deputies shall receive a sum to be fixed by the state nursery inspector with the approval of the secretary of the state board of agriculture, but which in no case shall exceed five dollars for each day's service required of him under this act, and his travelling and other expenses necessarily incurred in such service.

Section 18. Every person, firm or corporation, except common carriers, who shall receive, bring or cause to be brought into the state from such states, provinces or countries as may be designated by the secretary of the state board of agriculture, any fruits grown on plants, shrubs or trees of kinds which also grow out of doors in this state, shall immediately after the arrival thereof notify the state nursery inspector of such arrival and hold the same until they have duly been inspected.

Section 19. In case the nursery inspector, either personally or through his deputies, shall find plants known as ribes or five-leaved pines infected with the disease known as the white pine blister rust or shall find ribes or pines so situated that in his opinion they are in serious danger of becoming infected with this disease, he, either personally or through his deputies, may destroy or cause to be destroyed such ribes or five-leaved pines forthwith.

Section 20. In carrying out his duties under this act, concerning the control of the white pine blister rust, the state nursery inspector shall as far as practicable work in cooperation with the state forester and with the local tree wardens, moth superintendents, city foresters and forest wardens.

The state nursery inspector, acting under the direction of the state board of agriculture, is hereby authorized to expend a sum not exceeding fifty thousand dollars for the investigation and suppression of the white pine blister rust, and any unexpended balance of this sum remaining at the end of the fiscal year nineteen hundred and seventeen may be expended in the fiscal year nineteen hundred and eighteen.

Rhode Island.

Chapter 1540. An Act Providing for the Suppression or
Extermination of the White Pine Blister Rust.
Approved April 19, 1917.

It is enacted by the General Assembly as follows:

Section 1. The white pine blister rust, a disease of five needle pines and the species Genus Ribes, is hereby declared to be a public nuisance, and its suppression is hereby authorized and required; but no owner or occupant of an estate infested with such nuisance shall by reason thereof be liable to an action, civil or criminal, except to the extent and in the manner and form herein set forth.

Section 2. The state board of agriculture shall take steps to suppress the nuisance described in Section 1 of this chapter and to this end may make all necessary rules and regulations governing all work done under the provisions of this chapter. Said board may act in cooperation with any person or persons, corporation or corporations, including other states, or the United States, may make such rules governing the suppression or extermination of said disease, including the destruction of diseased or exposed species of five leaved pines and the diseased or exposed species of the Genus Ribes as it may deem necessary; may at all times enter upon the land of the state or of a municipality, corporation, or other owner or owners, and may use all reasonable means in carrying out the purposes of this chapter; and in the undertakings aforesaid, may in accordance with the provisions of this chapter, extend the funds appropriated therefor.

Section 3. The said board of agriculture shall make such rules and regulations as it may deem expedient in combatting the disease with reference to the transportation of five leaved pine trees and species of the Genus Ribes, or wood, lumber or other material derived from said trees, or shrubs, or in regard to the planting of said trees or shrubs.

Section 4. If in the opinion of said state board of agriculture or its duly appointed agents, it becomes necessary to destroy five leaved pines or species of the Genus Ribes not actually infected with said disease, the owner may receive compensation for any species of the Genus Ribes, it becomes necessary to destroy, if he make demand therefor within twenty-four hours after notification from said board of the intention to destroy the same. In case any owner shall make demand for compensation for the property it becomes necessary to destroy, then, and in that event, application shall be made to the secretary of the state board of agriculture to appoint some qualified disinterested person to appraise the value of the said

species of the Genus Ribes, that it becomes necessary to destroy, and the destruction of such property shall be deferred pending the appraisal of the value thereof. Said appraiser shall upon appraising the value of property that it becomes necessary to destroy certify the facts of such appraisal to the said state board of agriculture and the amount thereof shall be paid to the owner of such property and the destruction of such property shall thereupon proceed.

Section 5. Any town or city may make such an appropriation as it deems necessary toward the suppression of the said nuisance within its limits, and may appoint an official with such powers and limitation as it shall prescribe, to expend such appropriations in cooperation with the state board of agriculture.

Section 6. Any person importing into this state, or transporting from place to place within this state contrary to the rules or regulations of the said board of agriculture, any five leaved pines or species of the Genus Ribes, shall be fined not to exceed one hundred dollars.

Section 7. Any person who wilfully resists or obstructs any official or agent duly appointed by said board of agriculture while lawfully engaged in the execution of the purposes of this chapter, or who violates the provisions of Section 6 of this chapter, shall be deemed guilty of a misdemeanor, and upon conviction shall be fined not exceeding twenty-five dollars for each offense.

Section 8. To meet the expenses incurred under authority of this chapter, there is hereby appropriated, out of any money in the treasury not otherwise appropriated, the sum of two thousand five hundred dollars to be expended under the direction of the state board of agriculture; and the state auditor is hereby authorized to draw his order on the general treasurer, from time to time, for said sum or any part thereof, upon the presentation to him of vouchers duly approved by the executive committee of said board of agriculture and by the governor.

Section 9. All prosecutions under the provisions of this act shall be instituted by the secretary of the state board of agriculture, and shall be directed by him, and all penalties recovered for the violation of any of the provisions of this act shall be paid into the treasury of the state.

Section 10. This act shall take effect upon its passage.

Connecticut.

An Act Concerning Control of the White Pine Blister.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. The director of the Connecticut agricultural experiment station at New Haven shall have authority to investigate and control the fungous disease known as white pine blister rust or currant rust. Said director may appoint a member or members of the experiment station staff to administer such work under his direction, and may employ other assistance when necessary.

Section 2. All white pine, currants or gooseberries infected with said rust may be uprooted and destroyed forthwith. Said director may designate districts within which currant or gooseberry bushes growing wild, abandoned or escaped from cultivation may be uprooted and destroyed, under his direction, and in the performance of his duties he or any person authorized by him may at any time enter any public or private grounds, and any person wilfully hindering the performance of such duty shall be fined not less than ten dollars nor more than fifty dollars for each offense.

Section 3. The sum of seven thousand five hundred dollars is appropriated annually for carrying out the provisions of this act.

An Act making an Appropriation for Control of the White Pine Blister Rust.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

The sum of five thousand dollars is appropriated for the director of the Connecticut agricultural experiment station for controlling the fungous disease known as white pine blister rust or currant rust.

New York.

Chap. 283. An Act to amend the conservation law, in relation to control and suppression of white pine blister rust and currant rust.

Became a law April 28, 1917, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Article four of chapter six hundred and forty-seven of the laws of nineteen hundred and eleven, entitled "An act relating to conservation of land, forests, waters, parks, hydraulic power, fish and game, constituting chapter sixty-five of the consolidated laws," known as the conservation law, as

amended by chapter four hundred and fifty-one of the laws of nineteen hundred and sixteen and by chapter seventy-one of the laws of nineteen hundred and seventeen, is hereby amended by inserting after section fifty-seven a new section to be known as section fifty-seven-a, to read as follows:

57-a. Control of white pine blister rust and currant rust. For the purpose of suppressing and controlling white pine blister rust and currant rust, the following provisions shall apply:

1. Black currant declared a public nuisance. Planting, growing, propagating, cultivating or selling plants, roots or cuttings of any species of cultivated black currants (*ribes nigrum*, *ribes odoratum* or *ribes aureum*) within the state is hereby prohibited, except undiseased *ribes nigrum* in districts described in subdivision two. Such bushes, roots, cuttings or plants now planted or growing may be destroyed by the agents of the conservation commission, except those above permitted.

2. Fruiting currant districts defined. Districts where the growing of currants for the production of fruit is carried on extensively and is an important commercial enterprise shall be determined and designated as "fruiting currant districts," and in such districts the provisions of subdivision three of this section shall apply. The location and extent of such districts shall be determined by the conservation commission and the state department of agriculture.

3. Control measures in fruiting currant districts. In any fruiting currant district all five-leaved pine trees or five-leaved pine seedlings may be cut down or eradicated and the planting, growing or possession of them prohibited. Any diseased plants of the genus *ribes* or *grossularia* (currants and gooseberries) within such districts may be destroyed and fair compensation made therefor.

4. Control measures outside of fruiting currant districts. Whenever such action is desirable as a means of controlling white pine blister rust or currant rust, the commission or its duly authorized agents may cut down any five-leaved pine trees or eradicate any five-leaved pine seedlings or plants of the genus *ribes* or *grossularia* (currants and gooseberries) either wild or cultivated, except within nurseries which are annually certified by the state department of agriculture to be free from disease.

5. Quarantine regulations. The commission shall have the authority, by order, to establish quarantine districts in any part or parts of the state. In such districts it may prohibit the possession of any five-leaved pine trees or plants of the genus *ribes* or *grossularia* (currants and gooseberries) or so much thereof as is deemed necessary. It may also prohibit the transportation of any plants, roots or cuttings of the genus *ribes* or *grossularia* (cur-

rants and gooseberries) from or to any quarantine district within the state, or from any diseased area or locality in which the disease exists outside of the state to any point within the state. Such prohibitions shall be effective on and after the tenth day from the date of the order made with respect thereto. On the making of such an order the commission shall cause a certified copy of the same to be filed in the office of the clerk of each county affected by such quarantine and shall give such other notice thereof as it may deem necessary. The provisions of this subdivision shall not apply to undiseased cultivated plants or to the fruit of diseased plants of the genus ribes or grossularia (currants and gooseberries) included within fruiting currant districts or the merchantable contents of any pine trees provided any diseased part thereof is first destroyed.

6. Diseased trees or plants defined. A plant of the genus ribes or grossularia which is visibly infected by cronartium ribicola or any five-leaved pines upon which white pine blister rust has been found growing shall be construed to be and be, within the meaning of this section only, a diseased plant, and, as such, may be destroyed under the provision of this section.

7. Authority to eradicate and compensation. Agents or employees of the conservation commission may enter upon any land, in order to carry out the provisions of this section, if proper precautionary measures are taken by them to prevent the spread of this disease and no action for trespass shall lie therefor. Fair compensation shall be allowed for all trees or plants destroyed. The rate of such compensation shall be determined by the commissioner of agriculture or a committee appointed by him. If the commissioner shall determine to appoint a committee for the purpose of making such determination, such committee shall be appointed within thirty days after the taking effect of this act and prior to May first in each and every year thereafter.

2. This act shall take effect immediately.

Pennsylvania.

No. 60. An Act To provide for the protection of trees, shrubs, vines and plants, against destructive insects and diseases; providing for the enforcement of this act, the expenses connected therewith, and fixing penalties for its violation.

Section 1. Be it enacted, etc., That no person shall knowingly or wilfully keep any tree, shrub, vine or plant in any nursery, orchard, or public or private grounds, in this Commonwealth, nor knowingly or willing send out from such nursery any tree, shrub, vine or plant, affected with San Jose Scale, or other insects or diseases, such as crown-gall, black-knot or peach-yellows, destructive of such tree, vine, shrub or plant.

Section 2. It shall be the duty of the Secretary of Agriculture, through the Economic Zoologist, or such other agent or agents as he may select, to cause an examination to be made, at least once each year, of each and every nursery in this State where trees, shrubs, vines or plants are grown; and he may also, by himself or agent, make inspection of any orchard, or other grounds or place, in this State, for the purpose of ascertaining whether the trees, shrubs, vines or plants therein kept are infested with San Jose Scale or other insect pests, or diseases destructive of such trees, shrubs, vines or plants. If, after such examination of any nursery, it be found that the said trees, shrubs, vines or other plants, so examined, are apparently free in all respects from any such dangerously injurious insects or diseases, the Secretary of Agriculture or his duly authorized agent, or other person designated to make such examination, shall thereupon issue to the owner or proprietor of the said stock, thus examined, a certificate setting forth the fact of the examination, and that the stock or trees so examined are apparently free from any and all such destructive insects and diseases.

Section 6. If, after examination, or upon information given in writing to the Secretary of Agriculture, it is found that any nursery stock, trees or shrubs, either in a nursery or elsewhere, or sent forth to deliver in this State, are found to be infested with San Jose Scale, or other destructive insects or diseases, it shall be the duty of the Secretary of Agriculture, by himself or his duly authorized representative or agent, to take means to control, prevent the spread of, or secure the extermination of, such insects or diseases, and shall have power to enter upon the premises and order the examination and treatment, or destruction, of such dangerously injurious insects or diseases, or the nursery stock or trees and shrubs infested therewith, giving written notice to the owner or person in charge of the premises or nursery stock so infested. Such notice shall contain a brief statement of the facts found to exist, and descriptions of methods whereby it is deemed necessary to treat or destroy said trees, shrubs, vines or plants, and shall call attention to the law under which it is proposed to treat or destroy them. In case of objection to the findings of the inspector or agent of the Secretary of Agriculture, an appeal shall be made to the said Secretary of Agriculture, whose decision shall be final. An appeal must be taken within six days from the service of said notice, and shall act as a stay of proceedings until it is heard and decided.

Section 7. When the Secretary of Agriculture, or the persons or person appointed by him, shall finally determine, in accordance with the provisions of this act, that any trees, shrubs, vines or other plants, must be treated or destroyed, he shall notify in writing the owner or the person in charge of said infested stock, trees, vines or shrubs, and shall direct him, within a time and in a manner prescribed in such notice, to treat or destroy such infested property. If the person so notified shall refuse

or neglect to treat, destroy or disinfect said trees, vines, or shrubs, in the manner and within the time prescribed in the said notice, the Secretary of Agriculture shall cause such property to be so treated, and may employ all necessary assistants for that purpose; and such person or persons, agent or agents, employe or employes, may enter on all premises in any township, borough or city, necessary for the purpose of such treatment, removal or destruction, and he shall certify to the owner or person in charge of the premises the amount of the cost of said treatment, removal or destruction, and if not paid to him within sixty days thereafter, the same may be recovered, together with the costs of action.

Section 8. Any person violating the provisions of this act, or offering any hindrance to the carrying out of this act, shall be adjudged guilty of a misdemeanor, and, upon conviction before a magistrate or justice of the peace, shall be fined not less than ten dollars and not more than one hundred dollars for each and every offense, together with all the costs of the prosecution, and shall stand committed until the same is paid. All necessary expenses, under the provisions of this act, shall, after approval in writing by the Secretary of Agriculture and Auditor General, be paid by the State Treasurer upon warrant of the Auditor General, in the manner now provided by law: Provided, That not more than thirty thousand dollars shall be so expended, for this purpose, in any one year.

Section 9. All penalties and costs recovered for the violation of any of the provisions of this act shall be paid to the Secretary of Agriculture, or his agent, and by him immediately covered into the State Treasury, to be kept as a fund for the use of the Department of Agriculture in the enforcement of this act and may be drawn out upon vouchers signed by the Secretary of Agriculture and approved by the Auditor General and shall not merge with the general fund at the close of any fiscal year.

Section 10. The provisions of this act shall not apply to florists' greenhouse plants and flowers, known as greenhouse stock, of varieties not attacked by San Jose Scale or other injurious insects or diseases; nor shall they apply to ornamental trees and shrubs, of varieties not liable to infestation with San Jose Scale, and liable to injury by fumigation.

Section 11. All acts or parts of acts inconsistent with the provisions of this act be and the same are hereby repealed.

Approved - The 31st day of March, A. D. 1905.

Wisconsin.

An Act * * * creating a department of agriculture (and) * * * the office of state entomologist, * * * and prescribing their powers and duties.

The people of the State of Wisconsin, represented in Senate and Assembly, do enact as follows:

Section 1494-8. The inspector (State Entomologist) or his deputies shall have the authority to inspect any orchard, fruit or garden plantation, park, cemetery, private premises, public place, and any place which might become infested or infected with dangerous or harmful insects or plant diseases. He shall also have the authority to inspect or re-inspect at any time or place any nursery stock shipped in or into the state and to treat it as hereinafter provided.

Section 1494-9. The inspector with the approval of the department is hereby empowered to prohibit and prevent the removal or shipment or transportation of plant material and any other material from any private or public property, or property owned or controlled by the state or any area of the state which in his judgment contains dangerously infested or infected nursery stock or plant or other material of any kind for such periods and under such conditions as in his judgment seems necessary in order to prevent the further spread of the infestation or infection, giving such notice thereof as may be prescribed by the department; and during the existence of such order no person shall remove or ship from such area any such material whatsoever, except by special permission or direction of the inspector.

Section 1494-10. It shall be unlawful for any person in this state to knowingly permit any dangerous insect or plant disease to exist in or on his premises. It shall also be unlawful to sell or offer for sale any stock infested or infected with such insect or disease.

Section 1494-10b. 1. If the inspector or his deputy shall find, on examination, any nursery, orchard, small fruit plantation, park, cemetery or any private or public premises infested with injurious insects or plant diseases, he shall notify the owner or person having charge of such premises to that effect, and the owner or person having charge of the premises shall, within ten days after such notice, cause the removal and destruction of such trees, plants, shrubs or other plant material if they are incapable of successful treatment; otherwise, such owner shall cause them to be treated as the inspector may direct. No damage shall be awarded to the owner for the loss of infested or infected trees, plants, shrubs or other material under the provisions of sections 1491-1 to 1494-10i, inclusive, of the statutes.

2. In case the owner or person in charge of such premises shall refuse or neglect to carry out the orders of the inspector within ten days after receiving written notice, the inspector may proceed to treat or destroy the infested or infected plants or plant material. The expense thereof shall be assessed, collected and enforced against the premises, upon which such expense was incurred, as taxes are assessed, collected and enforced, and shall be paid into the state treasury.

Section 1494-10h. 1. Any person affected by any order of the inspector may appeal therefrom to the department within five days of the service of such order upon him, setting forth in writing specifically and in full detail the order on which a hearing is desired, and every reason why such order is deemed to be unreasonable.

2. On receipt of such appeal the department shall with reasonable promptness order a hearing thereon and consider and determine the matters in question. Notice of the time and place of hearing shall be given to the petitioner and to such other persons as the department may direct. Such appeal shall not suspend the operation of the order appealed from unless so ordered by said department. All hearings of the department shall be open to the public.

3. Deputies of the state entomologist shall receive not to exceed five dollars per diem and in addition thereto their actual and necessary traveling expenses while actually engaged in the discharge of their duties.

Section 1494-10i. 1. Any person violating any provision of sections 1494-1 to 1494-10i, inclusive, of the statutes, or any rule or regulation promulgated under the authority of said sections, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined by a sum of not less than twenty-five dollars nor more than five hundred dollars for each offense.

2. It shall be the duty of each district attorney to whom the state inspector or his deputies shall present satisfactory evidence of violation of any provision of sections 1494-1 to 1494-10i, inclusive, of the statutes, to prosecute without delay each such violation in the proper court.

Minnesota.

At the 30th session of the Minnesota Legislature convening during the winter of 1916-17, the passage of a law was secured (as an amendment to the already existing inspection law), intended to enable the Entomologist to handle the blister rust situation and other similar emergencies. The text of this amendment is here given.

Section 1-A. When any tree, shrub or plant, not itself diseased or infested, which is a host for any organism inducing a plant disease, new to or not heretofore widely prevalent or distributed within or throughout this state, or host for any destructive insect, new to or not heretofore widely prevalent or widely distributed throughout this state is situate within three thousand feet of any tree, plant or shrub which is infested with any such organism or insect, the State Inspector of Nurseries may for the purpose of preventing the spreading of such organism or insect, cause such tree, plant or shrub not itself so diseased or infested, to be destroyed as hereinafter provided:

(A) No tree, plant or shrub not itself diseased, shall be ordered destroyed without the approval in writing of the order therefor signed by a majority of a committee consisting of the Experiment Station Entomologist, President of the Minnesota Horticultural Society and the Director of the Minnesota Agricultural Experiment Station and by the Plant Pathologist of the Minnesota Agricultural Experiment Station, if a plant disease is concerned, or without opportunity being given to owner of such trees, plants or shrubs for an open hearing if he objects to such action on the part of the Inspector.

(B) When the destruction of any such trees, plants, or shrubs is determined upon, the State Inspector of Nurseries shall by notice in writing, approved as provided for in Subdivision "A" of this section, direct the owner or lessee of the land on which such plants, trees or shrubs are situate to destroy as many of such plants as the State Inspector may deem necessary, within such period of time as shall be therein specified, provided, however, such tree, plant or shrub shall not be required to be destroyed until the value thereof shall have been appraised as hereinafter provided.

(C) Immediately upon the issuance by the State Inspector of Nurseries of an order for the destruction of any trees, plants or shrubs, other than trees especially valuable for lumber, he shall designate three or more persons to be selected from the list of appraisers hereinafter provided for in Subdivision H of this section, to appraise the value of such trees, plants or shrubs.

(D) In case the order issued by the State Inspector of Nurseries directs the destruction of any tree, or trees, chiefly valuable for timber purposes, the same shall be appraised as hereinafter provided for by the State Forester, the Assistant State Forester or such suitable employe of the State Forester's department as shall be designated in writing by the State Forester.

(E) It shall be the duty of the appraisers so appointed to forthwith take and subscribe an oath to fairly and honestly determine the value of the trees, plants or shrubs so ordered to be destroyed and determine the fair cash value thereof at the place and in the condition the same may be in at the time of the issuance of the order. The appraisers so appointed shall receive as compensation for their services such sum, not to exceed six dollars per day, as shall be fixed by the State Inspector of Nurseries, for each day necessarily employed in the performance of their duties, together with the necessary traveling expenses and hotel bill, incurred in the performance of their duties, provided, however, that no officer or employe of the state shall receive any compensation for the performance of the duties herein imposed, but shall be reimbursed for his actual and necessary expenses. Such compensation and expenses, when approved by the State Inspector of Nurseries shall be audited and paid by the State Auditor from the appropriation made for the purposes of this act.

(F) The appraisers so appointed shall forthwith give notice to the owner or lessee of the land on which the trees, plants or shrubs ordered to be destroyed are situate of the time when they will visit the premises for the purpose of making their appraisal. Such owner or lessee shall at the time so specified, be given a full opportunity to be heard on the question of the value of the trees, plants and shrubs so ordered to be destroyed. The appraisers shall thereupon determine, as hereinbefore provided, the cash value of such trees, plants and shrubs and make and file with the State Inspector of Nurseries a report in duplicate of their appraisal and shall also give a copy thereof to the owner or lessee. The said reports shall each be signed by the appraiser. One of the copies thereof filed with such inspector shall be attached to a voucher, which voucher after approval by the State Inspector of Nurseries, shall be transmitted to the State Auditor for audit and after allowance by him the amount therein specified shall be paid from the money appropriated for the purposes of this act, to the owner of the trees, plants or shrubs ordered to be destroyed. The State Inspector of Nurseries shall attach to the voucher approved by him a certificate that the trees, plants and shrubs so appraised and specified in the voucher and appraisal have been destroyed in accordance with the order. The oath of the appraisers hereinbefore specified shall be attached to and filed with the copy of the appraisers' report filed with the State Inspector of Nurseries.

(G) Upon the delivery to him of the appraisers' report the owner or lessee of the land on which the trees, plants or shrubs ordered to be destroyed are situate, shall forth-

with destroy the same in the manner directed by the State Inspector of Nurseries, and within the time as specified in Subdivision B, and any owner or lessee who fails so to do within a period of five days after the expiration of said time specified in subdivision B shall be guilty of a felony and in addition to such criminal liability, the State Inspector of Nurseries may, after the failure of the owner or lessee for said five days to so destroy the same, cause the said trees, plants or shrubs to be destroyed at the expense of the owner, in the manner and as provided for in Section 1 of this act, and such expense in such case shall be deducted from the amount payable to the owner. Provided that said owner, lessee or representative shall not be guilty of felony if within five days after receiving the notice for the destruction of such trees, plants and shrubs as provided for in subdivision B he shall notify said State Inspector of Nurseries in writing that he prefers to have said State Inspector of Nurseries destroy such trees, plants and shrubs as provided in this section.

(H) It shall be the duty of the Executive Board of the State Horticultural Society and the Director of the Experiment Station each to furnish to the State Inspector of Nurseries a list of five practical horticulturists residing in several parts of the state who possess knowledge of the value of trees, plants and shrubs, from each of which the appraising committee is chosen.

(I) The State Inspector of Nurseries is hereby authorized and empowered to prohibit by proclamation the importation into this state of any plant, tree or shrub which has been grown or propagated in any state, province or county or in any place where it shall be determined by the said State Inspector of Nurseries after due investigation, that there exists and is prevalent to a dangerous extent, White Pine Blister Rust or any other plant disease or destructive insect new to Minnesota which is liable to or capable of spreading to and infecting the plants, trees and shrubs of this state and which may be carried and transported to and into this state on or in trees, plants and shrubs there grown. It shall be the duty of said State Inspector of Nurseries upon the making and promulgation by him of any such proclamation to forthwith mail a copy thereof to each certified nurseryman and to each railroad company doing business in this state and to publish a copy thereof in a newspaper published at the City of Duluth and at the City of St. Paul, and any person, firm or corporation or common carrier which shall after thirty days from the reception of said notice, introduce or transport into this state any tree, plant or shrub grown or propagated in the territory described in such proclamation, shall be guilty of a gross misdemeanor and in case the offender be a corporation, shall be punished by a fine of not less than five hundred or more than one thousand dollars for each shipment so introduced into this state.

STATE AND FEDERAL QUARANTINES FOR BLISTER RUST

January 1, 1918

State	Plants quarantined against:			Quarantined Area
	Currants & Gooseberries	White & other: 5-needed pines		
Calif-ornia	All kinds	All kinds		East of the Mississippi River.
Dela-ware	All kinds	All kinds		All points outside state
Idaho	All kinds	All kinds		N.H.,Vt.,Mass.,Conn.,N.Y.,Pa.
Ill.	All kinds	All kinds		New England States, Pa.,N.Y.,N.J. Ohio,Minn.,Wis.,either directly or indirectly.
Indiana	None	All kinds		All points outside state.
Kansas	All kinds	All kinds		All points outside state.
Maine	All kinds	All kinds		All points outside state except by permit from forest commissioner.
Mary-land	All kinds	All kinds		New England states, N.Y.,N.J.,Pa., Minn.,Wis.
Mass.	None	All kinds		Europe
Mich.	All kinds	All kinds		All points outside state.Currants and gooseberries allowed under permit from Nursery Inspector.
Minn.	All kinds	All kinds		New England states, N. Y., N.J., Pa.,Ohio, Wis.,Mich.
Montana	All kinds	All kinds		All points east of and including Minn., Iowa.,Mo.,Ark.,and La.
Nevada	All kinds	All kinds		East of Mississippi River and Minn-esota; all foreign countries.
No.Car.				
N. J.	None	All kinds		New England states, N.Y., Pa.,Minn. Wis.
	None	All kinds		New England states, N.J.,Pa.,Ohio, Ill.,Ind.,Minn.,Wis.
	All kinds	All kinds		Clinton Co.,Towns of AuSable,Black Brook and Peru
New York	All kinds	All kinds		Columbia County except Town of Kinderhook,Livingston,Stockport,Stuyvesant,Germantown and Clermont.
	All kinds	All kinds		All of Essex County.
	All kinds	All kinds		Niagara County,Towns of Porter, Lewiston and Niagara
	All kinds	All kinds		Rensselaer County,Towns of Berlin, Petersburg, Stephentown.
	All kinds	All kinds		All of Warren County

New York	:	:	:	:
Cont'd.	:	All kinds	: All kinds	: All of the Adirondack Park and Cat-skill Park.
Ohio	:	None	: W.pine and other 5-needled pines	: All points outside state, except by State Forester for scientific purposes.
Oregon	:	All kinds	: All kinds	: East of Mississippi River; all foreign countries
Penn.	:	None	: All kinds	: All points outside state
S.Dakota	:	All kinds	: All kinds	: New England States, N.Y., N.J., Pa., Ohio, Wis. and Minn.
Vermont	:	None	: All kinds	:
W. Vir.	:	All kinds	: All kinds	: All points outside state.
Wisconsin	:	None	: White pine and 14 other 5-needled pines	: All points outside state.
Canada	:	None	: All kinds	: All foreign countries.
United States	:	All kinds	: All kinds	: Europe and Asia
	:	All kinds	: All kinds	: Canada and Newfoundland
	:	All kinds	: All kinds	: All points east of and including Minn., Iowa, Mo., Ark., and La.
	:	Black	:	:
	:	Currants	: All kinds	: New England States and N. Y.



UPON

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PATENTED OCT. 10, 1904
DEC. 17, 1909

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IRVING-PITTSINGER CO.
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